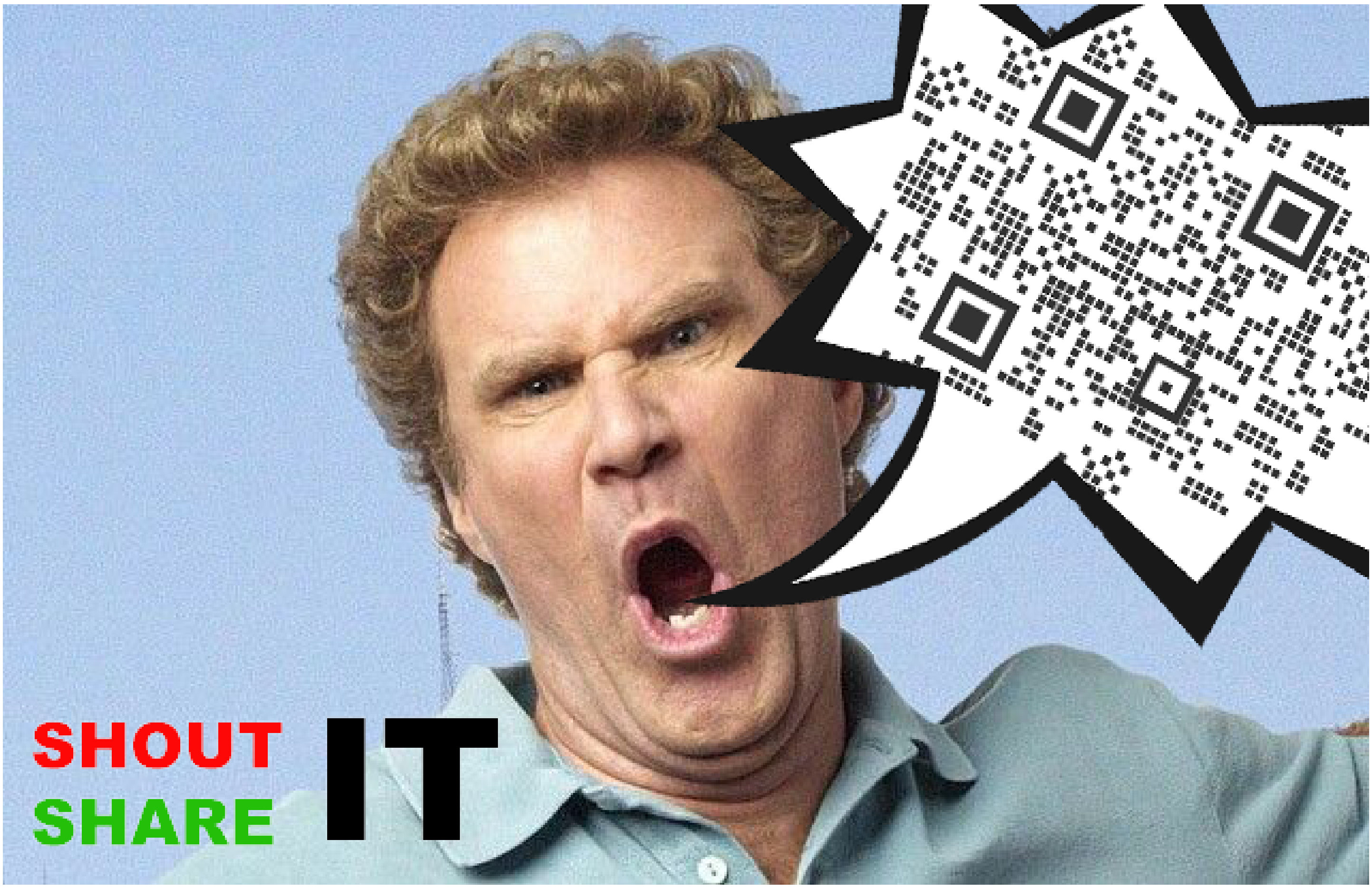
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MARGARET H. FULFORD

Issued 15 March 1963

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Volume 11 will be devoted entirely to the Manual of the Leafy Hepaticae of Latin America by Margaret H. Fulford. The price will be the same as for other volumes, $10.00. Volume 10 will be completed and Volume 12 begun without reference to the completion of Volume 11.

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Memoirs of The New York Botanical Garden Vol. 11

MANUAL

# of the

LEAFY HEPATICAE OF LATIN AMERICA

PART I

by

Margaret H. Fulford

TO DOROTHY

Leafy Hepaticae of Latin America
Part I

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*The key includes all the South American genera of the Lepidoziaceae; only the genus *Bazzania* is included in this part. The remaining genera of this family will make Part II.

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Errata

Page 72 line 9, for Guadeliupe read Guadeloupe

Page 73 line 20, for Brasil read Brazil

Page 90 line 14, for Luquilla read Luquillo

Page 106 line 2, the reference is

Brittonia 15:81. 30 Jan 1963

Publications

The information on the inside back cover is incorrect.

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INTRODUCTION

The concept of this work first became a reality twenty years ago at The New York Botanical Garden, where several Marshall A. Howe Fellowships helped to make possible the series of taxonomic studies begun at that time on the Lejeuneaceae and other families. With the assistance of two National Science Foundation Research Grants since July 1956, it has been possible to continue the work more intensively and extensively.

My purpose in attempting the study of the Latin American leafy Hepaticae has been threefold. The hepatics of tropical America and of the Southern Hemisphere have a special appeal to me in a number of ways. Little is known about them even at the present time, but this scant knowledge has raised many problems of far-reaching scope. There are more endemic genera and more aberrant taxa in South America than on any other continent. There are also many highly evolved, specialized forms, particularly in the northern part of the area, and at the same time, many simplified or primitive, radially erect forms in the south, for the most part restricted to the Patagonia–Tierra del Fuego area. Some of the latter genera and species have an Antarctic distribution, and are found also in New Zealand, Australia, and Tasmania, some also in the South Atlantic islands. Such taxa offer a wealth of new morphological fact, since in the past they have largely escaped notice, having been often buried within unrelated genera that are poorly represented and of little significance in the Northern Hemisphere.

The detailed knowledge of these southern taxa again raises the question of origin and phylogenetic relationships of the taxa of Hepaticae as well as the problems of the pathways of migration and the geographical relationships of the Latin American Flora with that of other continents.

The only possible way to attempt a study of any one of these problems was to first "put the genera in order" taxonomically, since up to now little or no work has been done on the genera. It has been necessary to make a monographic study (the first), of nearly every genus.

All the literature on the Latin American Hepaticae was assembled and a catalogue of all the species made. This file, together with Stephani's *Species Hepaticarum* I-VI and his *Icones Hepaticarum* (unpublished drawings), are the sources from which the list of species for each genus was compiled.

A very large number of unnamed collections, some 10,000 or more packets, have been borrowed from individual collectors, museums, and herbaria in this country, Europe, and Latin America. These have been sorted into genera and slides have been made from most of them.

In the study of each genus the types of all species were examined, either through a loan or on visits to the various herbaria. When the type, or in rare cases authentic material, was not found, the species was not included; names of such species are listed at the end of the genus. At least some of the illustrations were made from the type. The slides made from the undetermined material of the genus were then studied; they furnished valuable additional information on variation and distribution, and sometimes new species.

All the specimens that I have seen are listed in the detailed "distribution" that follows the description of each species. There is also a list of the reports of additional localities cited in the literature for which I have not seen specimens; these are given by country, with author and date of publication.

The outline of arrangement of the families and genera follows in a general way that of Evans (1939), except that the family Ptilidiaceae, long recognized as the repository for a large number of diverse, primarily exotic, unrelated taxa, is here considered in a narrow sense (and in this sense it apparently does not occur in Latin America). Some of the excluded genera do not occur in Latin America, some are more closely related to families which follow later in the classification, and some have been the bases for new families.

The sequence of the families and genera is not meant to be phylogenetic, for our knowledge is as yet too meagre to attempt to align these geologically very old, widely divergent, morphologic-taxonomic units in such a way. However, the first part contains most of the families with primitive characteristics and many genera, some very large, that seem to be geologically very old, as indicated by the several diverse lines of specialization coupled with diverse patterns of distribution within them.

The citation of the place of deposit of the type specimen has been exceedingly difficult, particularly for the older species. Many of the earlier hepaticologists sent a portion of the original collection of their new species to their coworkers and other herbaria. All these packets are labeled "original" or "type," either by the original author or later by someone else. Through the buying and selling of collections, and through the confusion and destruction of the war years, or often just through neglect over the years, it is often impossible to be sure which one of the several "types" is the specimen actually used by the author. Who is there to say which is the *type* and which the *isotype* following the Rules?

I feel that it is correct to designate all of these portions of the original collection (often only four or five stems in all), as the *type*, citing the several herbaria in which they are to be found. However, in an attempt to follow the Rules, I have arbitrarily cited one part as the type, the rest as isotypes, and have no doubt made many errors in so doing. For the species described by Stephani, the specimen at Geneva (if so indicated) is always designated *type*, and the parts of the original collections from Stephani's herbarium now at the Farlow Herbarium the *isotype*. When no type specimen has been found at Geneva it is assumed (perhaps incorrectly again) that all the material was returned to the collector or to the herbarium that had sent it out for naming, and the type is cited as being there.

ACKNOWLEDGMENTS

The Manual would not have been possible without the financial assistance of the National Science Foundation which has been generous in its support, with two successive grants, G 2616 and G 7147. These have made possible the purchase of scarce books and photostats to complete my literature of the Latin American Hepaticae, the study of type species in European herbaria, and a trip through Latin America. In addition, they have provided assistance with

the making of some of the illustrations, slide-making, typing, and the other details of this sort of investigation. Dr. Rogers McVaugh, Director for Systematic Biology when the work was begun, aided in the initial planning of the project, and succeeding Directors, Dr A. C. Smith and Dr. David Keck, have been most helpful. A further grant, G16810, to The New York Botanical Garden, has made it possible to publish the work in these MEMOIRS.

My research assistants in the early years of the project, Dr Jane Taylor and Dr Ray Hatcher, have contributed much to the taxonomic studies, illustrations, and determinations of species for a number of the genera. I have borrowed generously from their monographs on *Lepidozia, Trichocolea,* and *Isotachis.* Miss Sally Stevens has taken care of the card files and slides.

I am indebted to many libraries for their assistance in the search for literature and for making available the necessary photostats; the Lloyd Library of Cincinnati has been extremely helpful and the Librarian has given countless hours of assistance.

A great number of herbaria and museums here and abroad have been most generous in lending types and critical material, and I acknowledge my debt to them for their generous assistance. Without their cooperation the taxonomic studies would not have been possible. The many individual collectors, herbaria and museums that have so generously loaned their unnamed material have contributed to the scope of the work. All are designated, after the specimens cited, by the standard herbarium symbols.

The editors of a number of scientific serials in which some of the drawings had been published earlier have kindly given their permission for the use of these drawings in the Manual.

I express my appreciation to the New York Botanical Garden for publishing the work, the National Science Foundation for furnishing a grant to cover the cost of publication, and finally to the Editor, Dr Harold Rickett, for his assistance and patience in editing the manuscript.

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Key to the Genera

1. Leaves and underleaves undivided or only emarginate.
   2. Stems erect; leaves and underleaves similar in form and length.
      3. Plants green or brownish.
         4. Leaves large, rounded; antheridia borne on terminal discs surrounded by bracts and bracteoles. *Calobryum.*
         4. Leaves acute; antheridia axillary on short ventral sexual branches. *Micropterygium.*
      3. Plants dark brown; leaves ovate to ovate-lanceolate; antheridia axillary; archegonia few at the tip of the stem; leaves and underleaves several layers of cells thick. *Pachyglossa.*
   2. Stems distinctly dorsiventral, prostrate to ascending.
      3. Leafy stems irregularly pinnately branched; leaves often winged-keeled above. *Micropterygium.*
      3. Leafy stems appearing to be dichotomously branched; underleaves smaller than and different from the leaves (subentire species of *Bazzania* and *Acromastigum*).
         4. Leafy branches with seven longitudinal rows of cortical cells. *Acromastigum.*
         4. Leafy branches with more than seven rows of cortical cells. *Bazzania.*
1. Leaves variously divided.
   2. Leaves almost wholly divided into filiform segments, or appearing as masses of intricately interwoven cilia; lamina (when present) obscured by the mass of cilia.
      3. Leaves 2-, 3-, or 4-parted to the base, the segments unbranched, capillaceous; leaves transversely inserted. *Telaranea.*
      3. Leaves with a lamina, the segments and margins ciliate; leaves obliquely inserted and incubous or succubous, or transversely inserted.
         4. Leaves incubous, divided to the middle; cilia in opposite pairs on the segments, the cells short. *Lepidozia.*
         4. Leaves succubous or transversely inserted.
            5. Stems sparingly and irregularly branched, brownish-green; perianth long, with three rounded keels above, the surface without paraphyllia, the mouth not contracted. *Temnoma.*
            5. Stems distantly pinnate to closely and regularly bi- or tripinnate, light green, never pigmented with brown; perianth (if present), densely covered with paraphyllia; in some species a partial or complete coelocaule developed. *Trichocolea.*
   2. Leaves variously divided, at least a part of the lamina conspicuous.
      3. Leaves bifid; plants small to large, pigmented with brown.
         4. Plants small, light greenish-brown.
            5. Leaves two or more times as long as the underleaves; underleaves spinose-dentate. *Triandrophyllum.*
            5. Leaves and underleaves alike or nearly so.
               6. Branches frequent, both lateral and ventral; leaves transversely inserted (some 3-toothed); cortical cells of the stem in 12 longitudinal rows. *Paracromastigum.*
               6. Branches rarely produced, ventral (rarely lateral); leaves and underleaves obliquely inserted, incubous; cortical cells of the stem in many rows, smaller.
                  7. Line of leaf insertion hook-form or recurved at the dorsal end; sporophyte in a perianth; antheridia in the axils of both the male bracts and bracteoles *Triandrophyllum.*
                  7. Line of leaf insertion not hook-form above, sporophyte enclosed in an erect perigynium; antheridia only in the axils of the male bracts. *Isotachis.*
         4. Plants larger, often tending to be erect or pendent.
            5. Underleaves as large as and like the leaves, if smaller of a similar general pattern.
               6. Leaves long, rectangular to ovate-truncate, deeply bifid; segments long, lanceolate; cells thick-walled, of the margins more or less quadrate, of the inner part elongate forming a vitta; line of leaf insertion transverse or nearly so. *Herberta.*

6. Leaves ovate or ovate-truncate to orbicular, obliquely inserted, incubous.
7. Leaves with a small to large ventral keel in the upper part, often equitant. *Micropterygium*
7. Leaves without a keel or wing, never equitant.
8. Line of leaf insertion decurved, hook-form at the dorsal end; sporophyte enclosed in a perianth; antheridia in the axils of both male bracts and bracteoles. *Triandrophyllum.*
8. Line of leaf insertion not hook-form above; sporophyte enclosed in an erect perigynium; antheridia only in the axils of the male bracts. *Isotachis.*
5. Underleaves much smaller than the leaves and of a different form, or absent.
6. Stems appearing to be dichotomously branched.
7. Underleaves usually deeply 3-lobed (in American species); leafy branches with only seven longitudinal rows of cortical cells. *Acromastigum.*
7. Underleaves undivided, the margins variously toothed or lobed; leafy branches with many longitudinal rows of cortical cells. *Bazzania.*
6. Stems simple or irregularly branched; leaves keeled, at least above, the keel often winged.
7. Leaves bifid to one-fourth of their length; segments broadly triangular, coarsely toothed; underleaves absent. *Mytilopsis.*
7. Leaves very shortly bifid; segments only a few cells high, the margins entire or coarsely toothed; underleaves present or rarely absent. *Micropterygium.*
3. Leaves 3-, 4-, 5-, 6- to many-parted.
4. Leaves trifid (plants with quadrifid leaves may have the branch leaves trifid, or occasionally trifid leaves may occur along the stems).
5. Plants more or less erect and radial, the leaves and underleaves large, alike. *Triandrophyllum.*
5. Plants definitely dorsiventral, the underleaves conspicuously smaller than the leaves.
6. Plants appearing to be repeatedly dichotomously branched; leaves plainly incubous. *Bazzania.*
6. Plants irregularly branched; leaves transversely inserted or slightly succubous. *Bonneria.*
4. Leaves quadrifid for approximately one-half of their length.
5. Leaves bisbifid, the middle cleft deeper than the other two (some leaves on a stem unequally trifid or bifid); plants tending to be radially symmetric.
6. Plants pale green; both lateral and flagelliform branches present; globose masses of cells formed at the tips of the rhizoids; antheridia in the axils of both the male bracts and bracteoles; sporophyte enclosed in a coelocaule bearing female bracts and bracteoles similar to the leaves. *Vetaforma.*
6. Plants deeply pigmented with brown.
7. Plants large, robust, pinnate to bi- or tri-pinnate, the branches of limited growth; margins of the lamina and segments of the leaves and underleaves often with few to many cilia or laciniae; sporophyte enclosed in a fleshy coelocaule densely covered with scales and paraphyllia. *Lepicolea.*
7. Plants small, slender, the lamina of the leaves and underleaves under 0.5 mm broad; margins of the leaves and underleaves entire or rarely with a short tooth near the base.
8. Segments and lamina of the leaves and underleaves of several layers of cells; female bracts different from the leaves. *Herzogiaria.*
8. Segments and lamina of the leaves and underleaves unistratose except for a few-celled area at the base of each sinus; female bracts and bracteoles essentially like the leaves and underleaves; perianth five-keeled above. *Pseudolepicolea.*
5. Leaves quadrifid but not bisbifid (occasional leaves trifid or bifid, the branch leaves often trifid).
6. Line of leaf insertion transverse or essentially so.
7. Underleaves smaller than the leaves; at least one segment of an underleaf shorter than the rest. *Microlepidozia.*

7. Underleaves and leaves of similar size and form.

8. Margins of the leaves and underleaves entire or with only an occasional small tooth at the base.

9. Plants light to dark green, with or without only a little brown pigmentation.

10. Segments of the leaves and underleaves uniseriate. *Telaranea.*

10. Segments of the leaves and underleaves triangular. *Lembidium.*

9. Plants pigmented with brown, usually strongly so.

10. Segments triangular from a 2–10-celled base.

11. Leaves and underleaves without teeth near the base, or rarely with a short tooth; the segments entire. *Micrisophylla.*

11. Leaves and underleaves with a conspicuous long tooth suggesting a small segment, on one or both sides at the base; the segments usually with a single tooth or a pair of opposite spines, teeth, or short cilia in the lower part. *Temnoma.*

10. Segments uniseriate, occasionally from a 2- or 3-celled base.

11. Leaves and underleaves divided to the middle, the cuticle very coarsely striate; segments of the female bracts with several pairs of opposite cilia. *Temnoma.*

11. Leaves and underleaves divided to the middle or below, the cuticle verruculose to striolate; segments of the female bracts laciniate or ciliate but not with opposite pairs of cilia or teeth. *Microlepidozia.*

6. Line of leaf insertion oblique.

7. Leaves succubous, the segments divergent.

8. Leaf segments lanceolate from a 1–3-celled base, the tip long, accuminate, 4–6-celled; underleaves small, the segments similar. *Chaetocolea.*

8. Leaf segments shorter, from a mostly 4-celled base, the tip only 1- or 2-celled; underleaf segments unequal, variable. *Microlepidozia.*

7. Leaves incubous, flagelliform branches frequent.

8. Leaves long-decurrent.

9. Leaf-cells tending to be in longitudinal rows; segments (teeth) two to four cells long; stems with 12 longitudinal rows of cortical cells. *Neolepidozia.*

9. Leaf-cells not necessarily in rows; segments longer, straight to curved; stems with more than 12 longitudinal cortical rows of cortical cells. *Lepidozia.*

8. Leaves scarcely decurrent; plants large to small, irregularly branched, or pinnate to tripinnate; lamina with or without marginal teeth. *Lepidozia.*

4. Leaves 5-, 6-, to many-parted.

5. Line of leaf insertion transverse or nearly so; margins of the leaves and underleaves entire. *Telaranea.*

5. Line of leaf insertion oblique, the leaves incubous; margins of the leaves variously incised, toothed, ciliate, etc. *Lepidozia.*

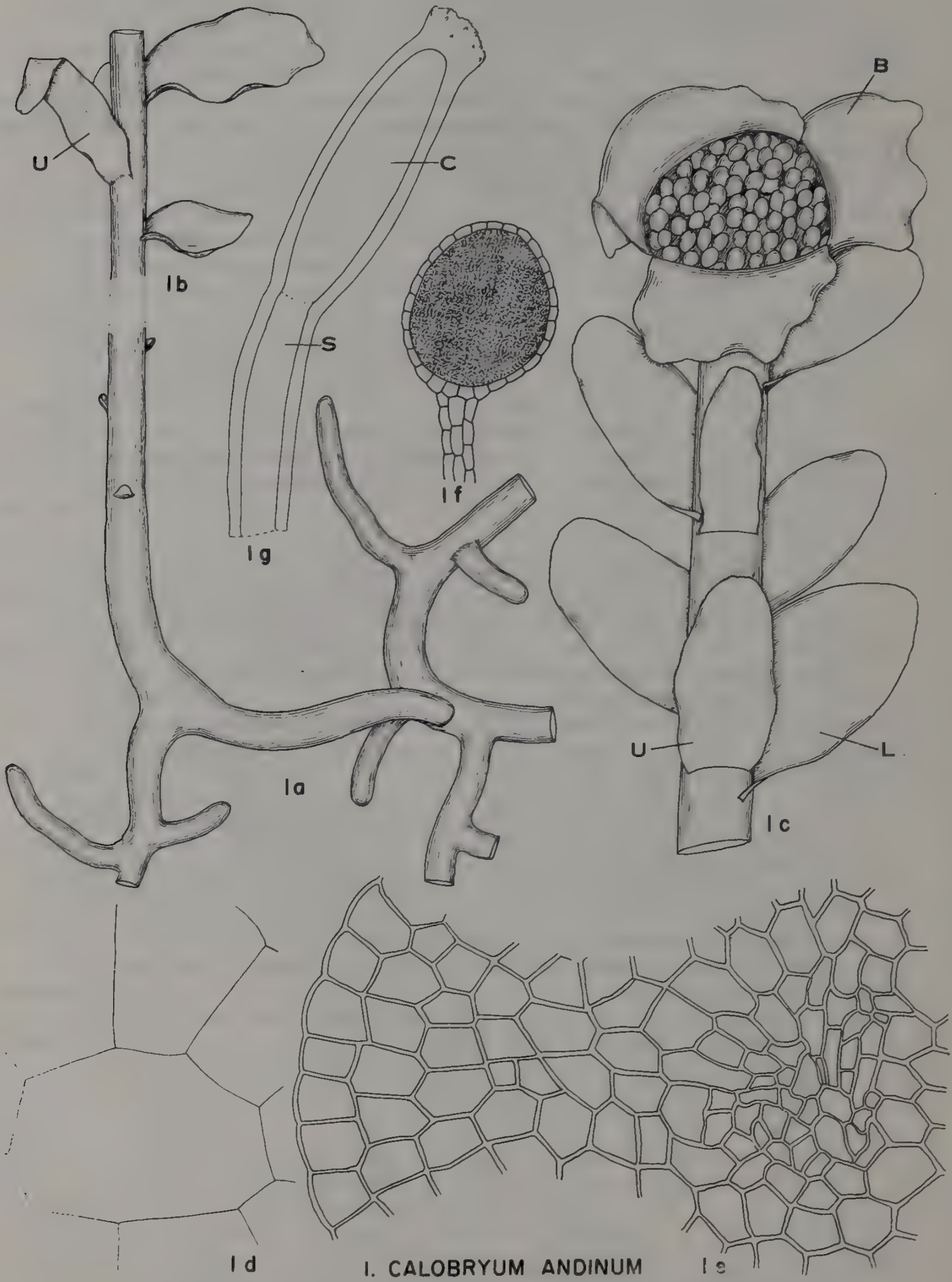


FIG. 1. *Calobryum andinum.* 1 a. Portion of a branched rhizome system, × 10. 1 b. Portion of a leafy shoot from this rhizome, × 10; U, underleaf. 1 c. Leafy shoot with an antheridial disc and numerous antheridia, surrounded by bracts and a bracteole, × 10; L, leaf; U, underleaf; B, bract.. 1 d. Leaf cell, × 350. 1 e. Transverse section of a portion of a stem, × 180. 1 f. Longitudinal section through an antheridium, × 90. 1 g. Longitudinal section through an immature sporophyte, × 90; C, capsule, S, seta.

CALOBRYACEAE Goebel, Ann. Bot. Gard. Buitenzorg **9**: 24. 1890; *emend.* Reimers, Syll. Pflanzenf. ed. 12. **1**: 227. 1954.

Leafy stems erect from an intricately branched rhizome system, tending to be radially symmetric, rarely branched; stem in transverse section of many thin-walled cells of more or less uniform size surrounding a central strand of smaller cells. Leaves large, entire, the underleaves similar. Antheridia borne in great numbers on a broad disc, surrounded by one or a few series of bracts and bracteoles larger than the leaves and underleaves; archegonia in clusters on a disc surrounded by one or a few series of bracts and bracteoles, larger but scarcely different from the leaves. Sporophyte/shoot relationship a shoot-calyptra. Perianth absent. Sporophyte long-stalked, the capsule long, cylindric, opening by two valves.

Type genus: *Calobryum* C. G. Nees.

As understood here, the family is monogeneric. The genus *Haplomitrium* C. G. Nees, which is usually included in the family, has been excluded because of the position of the antheridia and archegonia along the stem rather than on terminal discs.

Calobryum C. G. Nees in G. L. & N. Syn. Hep. 507. 1846.

Scalia Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 531. 1885.

The genus has the characteristics of the family.

Type species: *Monoclea blumii* Nees, Hep. Jav. 2. ? 1830.

This small genus with perhaps four species has a disjunct distribution in the tropics and Southern Hemisphere. Each of the species is restricted to one general area. Only one species is reported from the West Indies and South America.

1. **Calobryum andinum** (Spruce) Stephani, Spec. Hep. **1**: 400. 1900.

Haplomitrium mnioides (Gottsche ms.) Bescherelle, Jour. Bot. Morot **7**: 191. 1893.
Scalia andina Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 532. 1885.

Plants erect, tending to be more or less radially symmetric, light green, in tufts or in cushions among other bryophytes; leafy stems erect, 3–5.5 cm high, from an abundantly branched leafless rhizome; branches of the leafy stem not seen; stems in transverse section 25–30 cells across, the cells uniform, thin-walled except for the central "conducting core" six to eight cells across. Line of leaf insertion transverse to slightly oblique, the leaf sometimes decurrent to a greater or lesser degree. Leaves large, orbicular to rounded-ovate, to 2 mm long, entire or with an occasional tooth; leaf-cells large, 65–107 × 40–70 μ, the marginal rows smaller, the walls thin, the trigones very minute or absent, the cuticle smooth. Underleaves ligulate to narrowly orbicular, nearly as long as the leaves. Plants dioicous. Male inflorescence terminal on the leafy stem, the bracts and bracteole similar to the leaves but larger, surrounding a flat terminal disc bearing a great number of antheridia. Female inflorescence terminal, the archegonia also numerous on a terminal disc surrounded by one or two series of bracts and bracteoles, similar to but larger than the leaves. Perianth absent. The shoot/sporophyte relationship a shoot-calyptra with unfertilized archegonia over the surface. Shoot-calyptra several layers of cells thick, fleshy, 6 mm or more long at maturity, cylindric. Sporophyte stalk 27 μ or more long, the cylindric capsule 5 mm or more long, the wall of one layer of cells, the elaters uni- or bi-spiral with blunt ends, the spores 18 μ, striate-verruculose. Fig. 1, a–g.

Habitat: On decayed wood or over wet rocks in forests.

GUADELOUPE: Bois de la riviere Moire, 450–700 m, *Duss 156* (NY); s.l., *Duss 1041* (NY); forêt du Galion, *V. & P. Allorge, Crypt. l'Empire Col. Fr. Bryo.* II. 2 (Hb. Fulford.)
DOMINICA: Laudat, *Lloyd 98* (NY).
MARTINIQUE: La Proprett, 400–700 m, *Duss 267* (G).
PERU: Monte Pingulu, 1500 m, *Spruce, Hepat. Spruc.,* (isotype NY).

The species has also been reported in the following: Guadeloupe (*Jovet-Ast,* 1947; *Pagán,* 1942; *Stephani,* 1904); Martinique (*Stephani,* 1904); and Ecuador (Spruce, 1885).

BLEPHAROSTOMACEAE K. Müller, Rab. Krypt.-Fl. **6**^{4}: 591. 1954.

This monogeneric family apparently does not occur in Latin America. The species which in the past were assigned to the genus *Blepharostoma* Dumortier, are more closely related to genera in other families. The genus *Blepharostoma* with three or four species is widespread in Europe, Asia, and North America.

PSEUDOLEPICOLEACEAE Fulford & J. Taylor, Nova Hedwigia **1**: 411. 1960.

Plants erect, radial, irregularly branched, the branches both terminal, (*Frullania* and *Microlepidozia* types) and axillary-intercalary. Leaves bisbifid (some may be trifid or bifid); underleaves as large, similar. Male inflorescence terminal, becoming intercalary on the branch or stem, the bracts pouched, bearing antheridia, the bracteoles plane, like the leaves or underleaves. Female inflorescence terminal on the stem or a branch, the bracts and bracteoles similar to the leaves and underleaves. Perianth present, five-plicate.

Type genus: *Pseudolepicolea* Fulford & J. Taylor.

Pseudolepicolea Fulford & J. Taylor, Nova Hedwigia **1**: 412. 1960.

Lepicolea auctt. p.p.
Blepharostoma auctt. p.p.

Leafy stems erect, radial, deeply pigmented with brown, irregularly branched, the terminal branches both of the *Frullania* type, with the half-leaf at the dorsal base, and more rarely, of the *Microlepidozia* type, with the bifid half-leaf at the ventral base, the intercalary branches axillary, rare, from leaves and underleaves; stem in transverse section with a unistratose cortical layer of smaller cells and a medulla of numerous, distinctly larger cells. Rhizoids dark brown, infrequent, from the bases of leaves and underleaves. Line of leaf insertion transverse. Leaves bisbifid (occasional leaves trifid), unistratose, the lamina at the base of the sinus with a few additional enlarged, bulging superficial cells. Underleaves similar to the leaves. Male inflorescence terminal, soon becoming intercalary on the stem or branch, the bracts pouched, with segments shorter than those of the leaves, the bracteoles plane, similar to the leaves or underleaves, the segments shorter; antheridia in the axils of bracts. Female inflorescence terminal on a stem or branch, the bracts and bracteoles similar to the leaves and underleaves. Perianth inflated, obtusely five-plicate, the mouth denticulate-ciliate. Sporophyte not seen.

Type species: *Sendtnera quadrilaciniata* Sullivant.

This genus, with two species, is of interest because of the radial symmetry of the leafy stem, and the occurrence of lateral branches of both the *Frullania* and *Microlepidozia* types. The presence of branches of the *Microlepidozia* type suggests a close relationship to the Lepidoziaceae. However, the structure of the stem is different from the patterns found in that family, and the leaves are bisbifid with a modified cell structure at each sinus, so that there would be little justification for including *Pseudolepicolea* in that family. The genus is allied to *Lophochaete* Schuster, from Alaska, and is distinct from it. The genus *Blepharostoma,* to which the type species was assigned by Schiffner, has very different characteristics.

Key to the Species.

1. Leaf-segments long, widely spreading, lanceolate, mostly four cells broad at the base, the tip cell usually twice as long as broad. 1. *P. quadrilacinata.*
1. Leaf-segments shorter, erect-spreading, lanceolate, mostly six to eight cells broad at the base, the tip cell little longer than broad. 2. *P. georgica.*

1. Pseudolepicolea quadrilaciniata (Sullivant) Fulford & J. Taylor, Nova Hedwigia **1:** 413. *f. 32–40.* 1960.

Sendtnera quadrilaciniata Sullivant, Jour. Bot. Kew Misc. **2:** 317. 1850.
Leperoma (?) *quadrilaciniata* Massalongo, Nuovo Gior. Bot. Ital. **17:** 253. 1885.
Lepicolea quadrilaciniata Stephani, Bihang Sv. Vet.-akad. Handl. III. $\mathbf{26^6}$: 56. 1900.
Blepharostoma quadrilaciniatum Schiffner, Hedwigia **51:** 282. *f. 8–15.* 1911.
Lophochaete quadrilaciniata (Sullivant) Schuster, Jour. Hattori Bot. Lab. **23:** 199. 1960.

Plants of medium size, deep reddish-brown to blackish, tending to be radially symmetric, in erect tufts; stems slender, 7–8 cm high, with leaves to 2 mm wide, sparingly branched, the lateral branches long, leafy, of the *Frullania* type or rarely of the *Microlepidozia* type, or occasionally axillary-intercalary, the ventral branches rare, axillary-intercalary; stems in transverse section with a unistratose cortex of mostly smaller cells. Rhizoids infrequent, brown, from the bases of leaves and underleaves. Line of leaf insertion transverse. Leaves distant to imbricate, erect-spreading, bisbifid (some trifid) to two-thirds of their length; segments long, slender, tapering, widely divergent, lanceolate, mostly four cells broad at the base, the tip a row of three or more elongate cells, the end cell twice as long as broad; lamina cuneate, the area below each sinus thickened by a few bulging, variously oriented, superficial cells; leaf-cells at the base of the segment 30–50 × 24 μ, the walls thin, the cuticle faintly striolate. Underleaves like the leaves. Plants dioicous. Male inflorescence terminal, soon becoming intercalary on the stem, the bracts and bracteoles in three to seven series, the bracts deeply concave, the segments short, the bracteoles plane, similar to the underleaves; antheridia in the axils of the bracts. Female inflorescence terminal on the stem, without innovations, the bracts and bracteoles similar to the leaves and underleaves except for an occasional marginal tooth or a few basal cilia. Perianth inflated, with five broad keels, the mouth ciliate-dentate, contracted. Sporophyte not seen. Fig. 1, a–h.

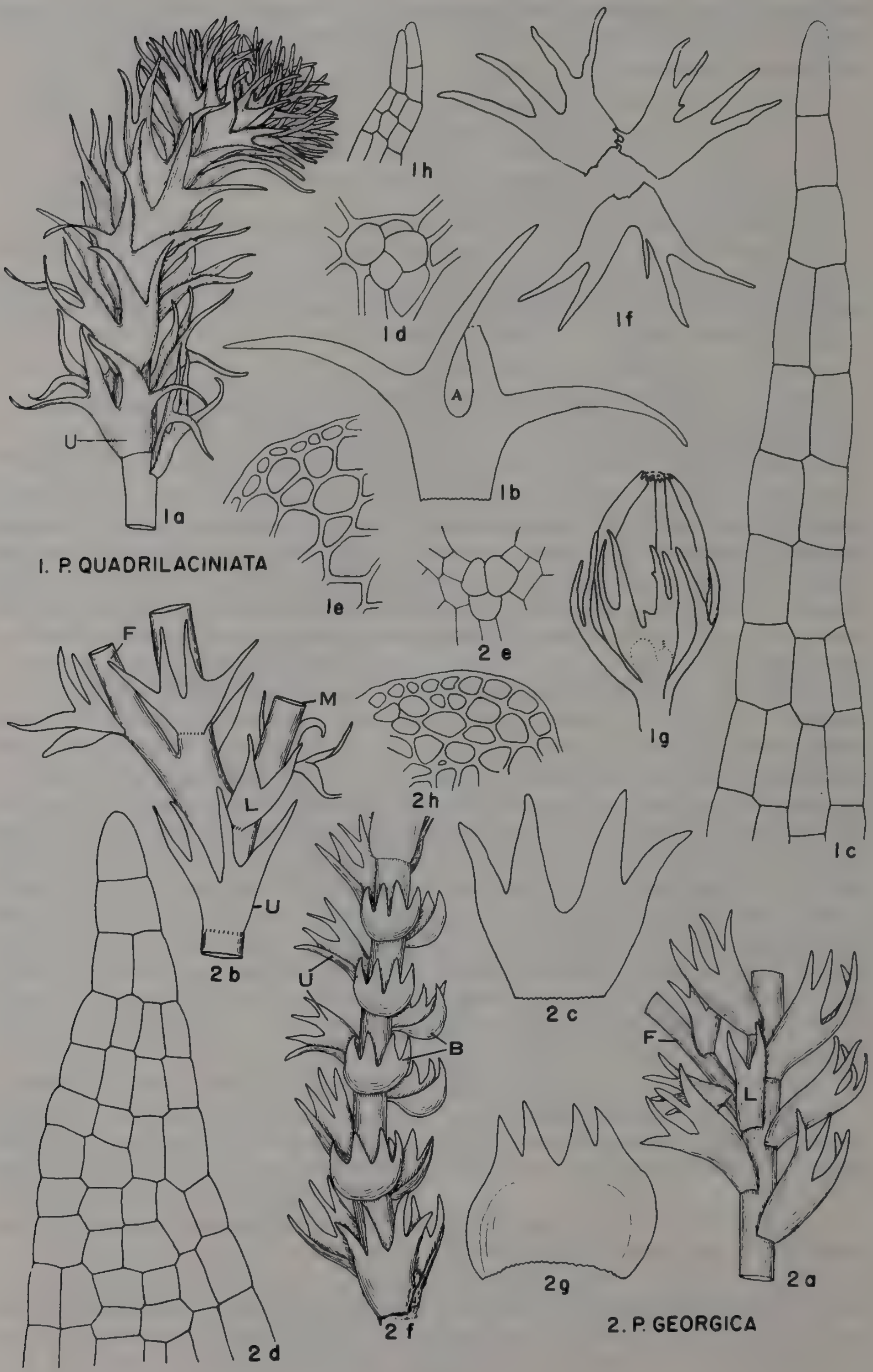
Habitat: On rocks and soil along streams in forests and alpine meadows.

PATAGONIA—TIERRA DEL FUEGO: "In valle fluminis Aysen," *Dusén* (lectotype NY; G); s Patagonia, *Skottsberg 606* [1908] (as *L. georgica*) (G); s.l., Cape Horn, Staten I., *Spegazzini* 117^2 (G); Desolation I., Puerto Angosta, 600 m, *Dusén 216* (G); Fuegia, *Dusén 216. 244* (G).

Additional localities in this area are cited by the following authors: Massalongo (1885), Stephani (1901a, 1911).

2. Pseudolepicolea georgica (Stephani) Fulford & J. Taylor, Nova Hedwigia **1:** 416. *f. 41–51.* 1960.

Lepicolea georgica Stephani, Sv. Vet.-akad. Handl. $\mathbf{46^9}$: 73. *f. 28, f–g.* 1911.


1h
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1. P. QUADRILACINIATA
1e
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2. P. GEORGICA

Plants of medium size, tending to be radially symmetric, deep reddish-brown to black, in erect tufts or among other bryophytes; stems slender, 3–6 cm high, with leaves to 2 mm wide, sparingly branched, the lateral branches of the *Frullania* type, more rarely of the *Microlepidozia* type, or occasionally intercalary in the axils of the leaves, the ventral branches rare, axillary-intercalary; stem in transverse section with a unistratose cortex of mostly smaller cells than those of the medulla. Rhizoids occasional, brown, from the base of an underleaf. Line of leaf insertion transverse. Leaves distant to approximate, patent-divergent, bisbifid to three-fifths of their length; segments lanceolate, the base mostly six to eight cells broad, the tip ending in a row of two or three cells little longer than broad; lamina cuneate, the area just below each sinus often thickened with a few additional bulging, variously oriented superficial cells; leaf-cells at the base of the segment 18–36×18–24 μ, the walls thin, the cuticle faintly roughened. Male inflorescence terminal but becoming intercalary through growth of the stem, the bracts and bracteoles in three to ten series, the bracts concave, with segments shorter than those of the leaves, the bracteoles plane, scarcely smaller than the underleaves. Female inflorescence and sporophyte not seen. Fig. 2, a–h.

Habitat: Along streams, on wet glacial detritus and in wet alpine meadows.

PATAGONIA—TIERRA DEL FUEGO; Puerto Bueno, *Dusén* [no. 33] coll. 25. 1. 1896, (as *L. quadrilaciniata* (NY); same locality, *Dusén*, ex Upsala Bot Mus. (G);

SOUTH GEORGIA: Cumberland Bay, *Skottsberg* 156, coll. 18. 4. 1909, (type S-PA), *Skottsberg 157* (as *L. quadrilaciniata*) (S-PA); Georgia antarctica: without locality, *Skottsberg*, coll. 1909, "portion of the original" (type G).

HERZOGIARIACEAE Fulford, Nova Hedwigia 1: 399. 1960.

Plants erect, more or less radially symmetric, deep brown to black, irregularly branched, the branches intercalary, axillary above half a leaf or underleaf; stem in transverse section with the single layer of cortical cells only slightly smaller than those of the medulla, all the cells very thick-walled. Leaves bisbifid to one-half or more, pluristratose, the thick lamina with an enlarged multicellular pore- or knot-like protuberance at the base of each sinus, the cell walls very thick. Underleaves like the leaves. Male inflorescence terminal, becoming intercalary on the stem or branch; bracts and bracteoles like the leaves, the bracteoles plane, without antheridia. Female inflorescence terminal on a stem or branch, the inner series of bracts and bracteoles very different from the leaves. Perianth present.

The plants of this monotypic family from southern South America are aberrant but also show certain primitive characteristics.

FIG. 1. *Pseudolepicolea quadrilaciniata.* 1 a. Stem with leaves and underleaves, × 30: U, underleaf. 1 b. Bisbifid leaf, × 80; A, the middle sinus. 1 c. Portion of a leaf segment, × 350. 1 d. Leaf cells at the base of the sinus on the lamina, × 350; from A in Fig. 1 b. 1 e. Portion of a transverse section of a stem, × 180. 1 f. One series of female bracts and bracteole. 1 g. Perianth with the innermost series of bracts. 1 h. Cells of the perianth mouth.

FIG. 2. *P. georgica.* 2 a. Stem, dorsal view, × 30; F, branch of the *Frullania* type; L, half-leaf with this branch. 2 b, Stem, ventral view, × 40; U, underleaf; F, branch of the *Frullania* type; M, branch of the *Microlepidozia* type; L, half-leaf with this branch. 2 c. Leaf, × 80. 2 d. Portion of a leaf segment, × 350. 2 e. Accessory leaf cells at the base of the sinus of a leaf, × 300. 2 f. Portion of a male inflorescence, × 40; B, concave male bracts; U, plane bracteoles. 2 g. Male bract, × 40. 2 h. Portion of a transverse section of a stem, × 180.

FIGS. 1 f–h after Schiffner, 1911; others after Fulford & Taylor, 1960.

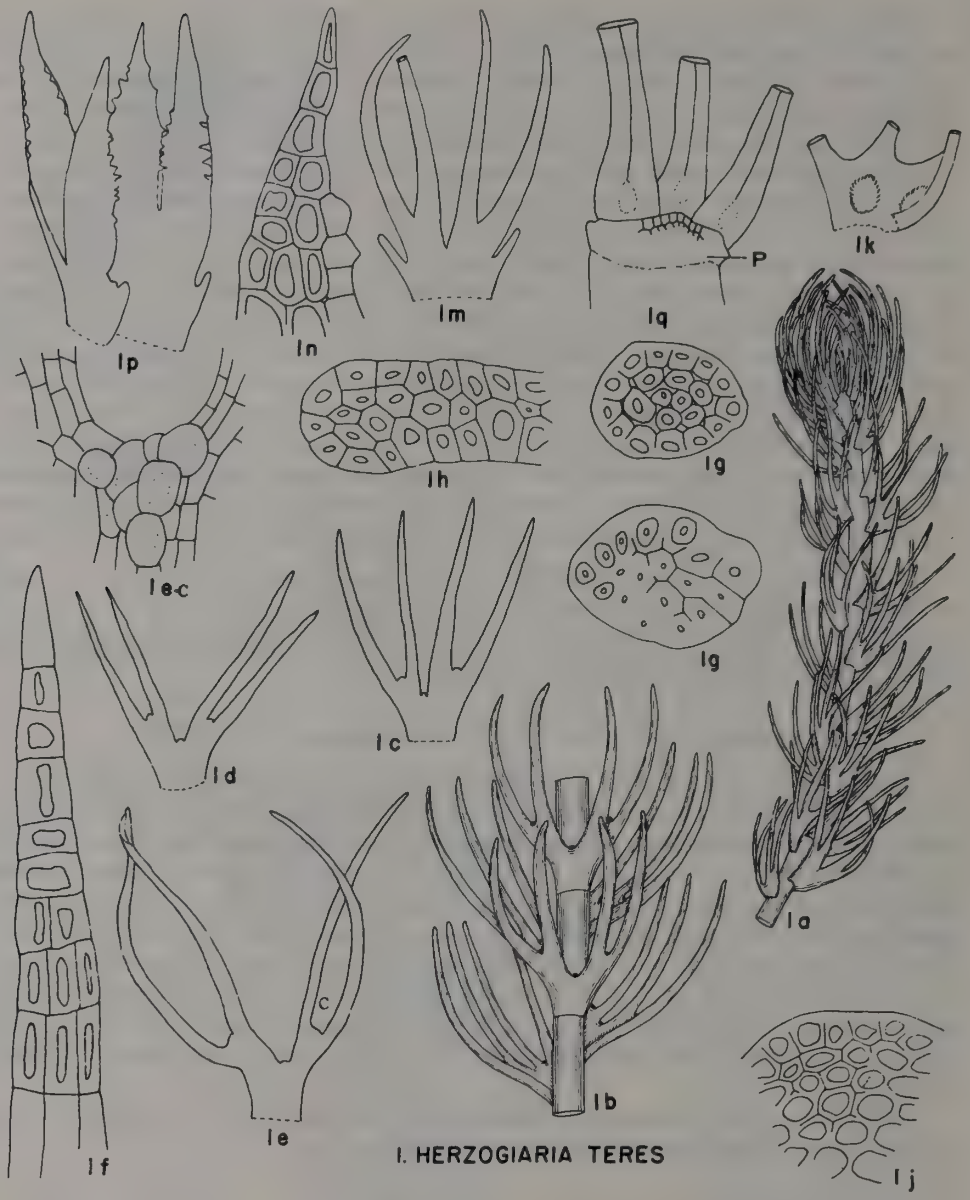

FIG. 1. *Herzogiaria teres.* 1 a. Stem, dorsal view, × 25. 1 b. Stem, ventral view, × 40. 1 c. Leaf, × 30. 1 d. Underleaf of the same series, × 30. 1 e. Another leaf, × 40. 1 e-C. Cells of the sinus which form the pore-like protuberance, × 180. 1 f. Tip of a segment, × 350. 1 g. Transverse sections of leaf segments, × 180. 1 h. Portion of a transverse section through the leaf lamina, × 180. 1 j. Portion of a transverse section of a stem, × 180. 1 k. Male bract with two depressions in the lamina, × 18. 1 m. Female bract of the outer series, × 18. 1 n. Upper part of a bract of the intermediate series, × 180. 1 p. Bract of the innermost series (immature), × 45. 1 q. Archegonia surrounded by a very young perianth, × 90; P, perianth.

All after Fulford, 1960.

Herzogiaria Fulford, Nova Hedw. **1**: 397. 1960.

Lepicolea auctt. p.p.

The characters of the genus are those of the species.

Type species: *Lepicolea teres* Stephani.

Herzogiaria teres (Stephani) Fulford, Nova Hedwigia **1**: 398. 27 f. 1960.

Lepicolea teres Stephani, Bihang Sv. Vet.-akad. Handl. III. **26**^{17}: 26. 1901.
Lepicolea algoides Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 73. *f. 28, d–e.* 1911.

Plants of medium size, radially symmetric, erect, bristly, in brownish-black tufts; leafy stems 5–6 cm long, to 1.5 mm wide, irregularly branched, the branches axillary-intercalary, above either half of the leaf or underleaf, frequently from the axils of male bracts or bracteoles of a terminal inflorescence; branches like the stem, or more slender and microphyllous with trifid leaves; stem in transverse section having the cells of the medulla a little larger, the walls thin, dark brown, with a broad band of brownish-yellow translucent secondary thickening. Rhizoids occasional, dark brown, from the base of the underleaf. Line of leaf insertion transverse or nearly so. Leaves erect-spreading, approximate to imbricate, symmetric, cuneate, 2–2.5 mm long, pluristratose throughout, bisbifid to three-fourths of their length (more rarely trifid with one sinus deeper, or bifid); segments cone-shaped, long, erect-spreading, 4–5 × 6–7 cells thick below, tapering to the uniseriate tip of two to four cells, the surface cells rectangular in outline, the cell walls thickened as in the stem; lamina cuneate, of two or three layers of thick-walled cells, the cells in the curve of each sinus large or small, bulging, irregularly arranged, forming an enlarged pore- or knot-like protuberance; surface cells of the lamina 54–72–88 × 18–24 μ in outline, thick-walled. Underleaves not different. Plants dioicous, with male and female plants in the same tuft. Male inflorescence terminal but becoming intercalary on the stem or branch, sometimes branched, the bracts and bracteoles in six or more series, like the leaves, with four, three, or two segments, the bracteoles without antheridia, the bracts plane to more or less pouched, or with one or two depressions; antheridia small, one or two, in the axils of the bracts, the stalk short; paraphyses occasional. Female inflorescence terminal on a stem or branch, without innovations, the bracts and bracteoles similar, in several series; outermost series similar to the leaves but with broader flattened segments, the margins in part unistratose, the intermediate series with broader triangular segments with broad unistratose margins, the inner series with broad, unistratose, triangular segments with sparingly to abundantly crenulate to short-ciliate margins; archegonia seven to ten, the venter broader than the neck; linear or filamentous paraphyses few. Mouth of the (immature) perianth undivided, undulate, entire. Mature perianth and sporophyte not seen. Fig. 1, a–q.

Habitat: In rocky brook and small lagoon.

PATAGONIA—TIERRA DEL FUEGO: Ushuaia, *Dusén 296* (G); Fuegia, *Dusén* (G). Isla Pacheco, *Skottsberg*, type of *L. algoides* (G).

VETAFORMACEAE Fulford & J. Taylor, Nova Hedwigia **1**: 405. 1960.

Plants erect, radially symmetric or nearly so, green, without brown pigmentation, irregularly branched; branches both terminal (*Frullania* type) and intercalary in origin, the intercalary branches axillary, or on the stem at the ventral side of the leaf, or at either side of the underleaf. Line of leaf insertion transverse. Leaves bisbifid (or trifid with one sinus deeper, or bifid). Underleaves like the leaves. Male branches terminal but becoming intercalary on the stem or branch, radial, the bracts and bracteoles pouched; antheridia in the axils of the bracts and bracteoles. Female inflorescence terminal on the stem or branch, usually with one or two subfloral innovations, the bracts and bracteoles like the leaves. Sporophyte enclosed in a long, smooth, club-shaped coelocaule, the bracts and bracteoles in rows on the surface.

Type genus: *Vetaforma* Fulford & J. Taylor.

This monogeneric family from southern South America has a considerable number of exceedingly primitive characteristics.

Vetaforma Fulford & J. Taylor, Nova Hedwigia **1**: 406. 1960.

Lepidozia auctt. p.p.
Lepicolea auctt. p.p.

The characters of the genus are those of the species.

Type species: *Lepidozia dusenii* Stephani, 1900.

1. **Vetaforma dusenii** (Stephani) Fulford & Taylor, Nova Hedwigia **4**: 82. 1962.

Lepidozia dusenii Stephani, Bihang, Sv. Vet.-akad Handl. III. **26**^{6}: 52. 1900.
Blepharostoma dusenii Stephani, Spec. Hep. 3: 640. 1909. [not "loc. cit" of the above (1900), as incorrectly cited by Stephani in later works.]
Lepicolea abnormis Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 72. 1911.
Vetaformis abnormis (Stephani), Fulford & J. Taylor, Nova Hedwigia **1**: 406. f. 1–31. 1960.
Temnoma dusenii (Stephani) Schuster, Bryologist **62**: 240. 1959.

Plants of small to medium size, erect, radially symmetric or nearly so, flaccid, pale green, in tufts or among other bryophytes; stems slender, to 4 cm long, with leaves to 1.0 mm wide, irregularly branched; lateral branches frequent, of the *Frullania* type with the bifid half-leaf at the dorsal base, or axillary-intercalary, the intercalary branches also from the stem at the ventral base of the leaf, or at either side of the underleaf, or in the axils of male bracts and bracteoles, the subfloral innovations of the *Frullania* type; stem in transverse section seven to nine cells across, the cells of the unistratose cortical layer mostly smaller than those of the medulla, the walls thickened, trigones and pits present. Rhizoids very long, hyaline, from the bases of the leaves and underleaves of the lower part of the stem, and the cells surrounding the bases of the lower intercalary branches, 18–26 μ wide, producing terminal, multicellular regenerant protonemata, which become intercalary by the development of more rhizoids with regenerant tips. Line of leaf insertion transverse. Leaves distant to imbricate, erect-spreading, cuneate, 0.8–1.0 mm long, bisbifid (some trifid with one sinus deeper, rarely bifid) to one-half of the length; segments lanceolate, erect-spreading, four (three to six) cells wide at the base, the apex short-acuminate, ending

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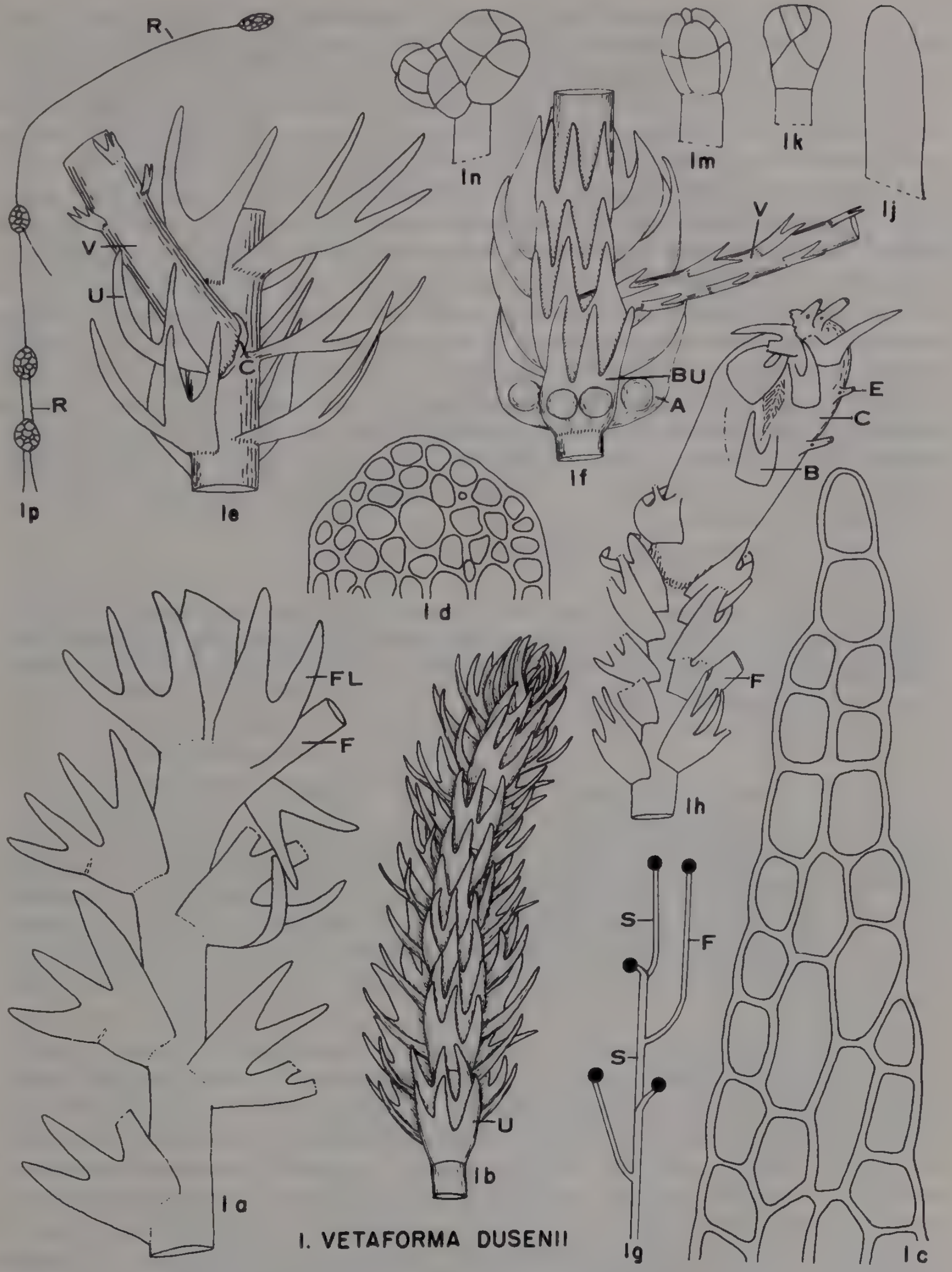
FIG. 1. *Vetaforma dusenii.* 1 a. Portion of a stem, dorsal view, × 40; F, branch of the *Frullania* type; FL, half-leaf with this branch. 1 b. Portion of a stem, ventral view, × 30; U, underleaf. 1 c. Portion of a leaf segment, × 350. 1 d. Portion of a transverse section of a stem, × 180. 1 e. Lateral view of a stem, showing an intercalary branch, × 40; C, basal collar at the ventral base of the leaf; U, underleaf; V, intercalary branch. 1 f. Male inflorescence, × 40; A, antheridium; BU, male bracteole; V, ventral axillary, intercalary flagelliform branch. 1 g. Diagram to show the arrangement of female inflorescences on a shoot; the dark circles indicate the female inflorescences; F, vegetative branch of the *Frullania* type; S, sub-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I. VETAFORMA DUSENII

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floral innovation, also of the *Frullania* type. 1 h. Leafy stem with a coelocaule surrounding the sporophyte, × 20; B, female bract; C, coelocaule; E, unfertilized archegonium; F, branch of the *Frullania* type. 1 j. Tip of a rhizoid, × 180. 1 k–n. Stages in the development of a regenerant protonema at the tip of a rhizoid, × 180. 1 p. Diagram to show the arrangement of regenerant protonemata in a rhizoid system.

All after Fulford & Taylor, 1960, 1962.

in a row of two cells; lamina as long as the segments, the margin entire; leaf-cells of the base of a segment 36–90 × 27–30 μ, the marginal cells smaller, the walls uniformly thickened, without trigones, the cuticle faintly striate. Underleaves like the leaves. Plants dioicous. Male inflorescence terminal on the stem or branch, soon becoming intercalary, the stem showing a series of shorter bracts and bracteoles separated by series of normal leaves and underleaves, the bracts and bracteoles similar, slightly smaller than the leaves, in four to ten series, mostly trifid, deeply pouched; antheridia large, spherical, pale, in the axils of both bracts and bracteoles, the wall cells hexagonal in outline, the stalk six or more cells long. Female inflorescence terminal on a stem or branch, usually with one or two innovations of the *Frullania* type, the bracts and bracteoles in three series, like the leaves; archegonia six to ten, cylindric, the necks broad. Perianth absent. Sporophyte enclosed in a coelocaule; coelocaule long, club-shaped, several layers of cells thick, the surface without paraphyllia, bearing the three series of bracts and bracteoles in three rows; unfertilized archegonia at and near the tip. Vegetative reproduction through globose or cylindric masses of cells (protonemata) produced at the tips of the rhizoids. Sporophytes not seen. Fig. 1, a–p.

Habitat: Sand and glacial detritus in wet places.

PATAGONIA—TIERRA DEL FUEGO: "In valle fluminis Aysen in rupibus" *Dusén 275* [1897] (type UPS; isotype S-PA); same locality, *Dusén 275* ex parte, type of *Blepharostoma dusenii* (G-1790), another packet (?), without number (G-1791); Isla Huafo, Cal. Samuel, Halle, type of *Lepicolea abnormis* (G); estuary of the Ventisquera River, *Skottsberg 606* with *Lepicolea* [*Pseudolepicolea*] *georgica* (G).

LEPICOLEACEAE Schuster, Revue Bryol. Lichénol. **26**: 126. 1957.

Caules recti, radiales, pinnati, ramis apicalibus (*Frullaniae* typus) atque in axillis foliorum; folia incuba, bisbifida (vel trifida, bifida); amphigastria similia. Inflorescentiae masculae apicales vel in cauli intercalares, antheridiis in axillis bractearum; inflorescentia feminea apicalis in cauli, 1 vel 2 innovationibus instructa, archegoniis e paucis ad plures quam 50. Coelocaulis carnosus, clavatus, squamosus, et paraphylliis instructus. Capsulae paries quinqueseriatus.

Plants tending to be radially symmetric, pigmented with brown; branches terminal in origin (*Frullania*-type) or rarely axillary in the leaves, of limited growth. Line of leaf insertion transverse, or oblique with the leaves incubous. Leaves bisbifid (rarely some trifid or bifid on a stem). Underleaves similar to the leaves, scarcely smaller. Male inflorescence terminal, becoming intercalary on a lateral branch; antheridia in the axils of the bracts. Female inflorescence terminal on the stem, with one or more subfloral innovations, the bracts and bracteoles in several series, similar to the leaves and underleaves; archegonia from few to 50 or more. Shoot/sporophyte relationship a fleshy, club-shaped coelocaule, covered with scales and paraphyllia, with unfertilized archegonia at the tip. Sporophyte seta in transverse section of many cells, the outer layer of 32 large cells, the inner cells slightly larger. Capsule wall of five layers of cells with characteristic wall thickenings; elaters long, slender, uni- or bispiral but with solid tapering ends. Sporeling protonema globose.

Type genus: *Lepicolea* Dumortier.

Lepicolea Dumortier, Recueil Obs. Jungerm. 20. 1835.

Jungermannia auctt. p.p.
Herbertus S. F. Gray, Nat. Arr. Brit. Pl. 1: 678, 705. 1821.
Schisma auctt. pp.
Sendtnera auctt. p.p.
Leperoma Mitten, in J. D. Hooker, Handb. N. Zeal. Fl. 754. 1867.

Plants large, coarse, tending to be radially symmetric, yellow-brown to dark brown, with or without stem paraphyllia, regularly pinnate or bipinnate; lateral branches of limited growth, numerous, of the *Frullania* type with the half-leaf dorsal, or rarely axillary-intercalary, spreading, decurved in the outer parts, often becoming attenuate with smaller, trifid or bifid leaves and underleaves, to flagelliform with scale-like leaves; stem in transverse section with a cortical band of one or two to four layers of very thick-walled cells surrounding the medulla of larger cells with thick walls, trigones, and pits. Rhizoids colorless, from the scales of the flagelliform branches, rarely from the underleaves. Line of leaf insertion transverse, or oblique with the leaves incubous. Leaves large symmetric or asymmetric, rectangular, bisbifid (rarely bi- or trifid) to one-half of their length, the middle cleft always the deepest; segments lanceolate, undivided to ciliate-laciniate, the tips uniseriate, often long and hyaline; margins of the lamina entire to ciliate or laciniate; leaf-cells large, tending to be in rows, with thick walls, large trigones and deep pits, often with a band of additional thickening, a vitta of larger cells often present, the cuticle verruculose to striolate. Underleaves symmetric, bisbifid, scarcely smaller than the leaves. Branch leaves and underleaves smaller, usually with one segment less than those of the stem. Plants dioicous or monoicous. Male inflorescence terminal or intercalary on a vegetative branch, the bracts pouched, the bracteoles plane; antheridia one or two in the axils of the bracts, globose, the stalk long, of two rows of cells; paraphyses occasional. Female inflorescence terminal on the stem or a leading branch, with one to three innovations, the bracts and bracteoles in several series, similar to the leaves and underleaves, larger, the inner series becoming fragmented as scales on the developing coelocaule; archegonia eight to many (54+), among paraphyllia, bracts, bracteoles, and paraphyses at the tip of the stem. Perianth absent. Sporophyte enclosed in a thick-walled coelocaule covered with scales and paraphyllia; sporophyte foot inverted-cone-shaped, deeply embedded in the stem; seta short, in transverse section with an outer ring of 32 large cells surrounding a greater number of slightly larger cells. Capsule dehiscing by four valves, the old valves often splitting further; capsule wall of five layers with characteristic wall thickenings; elaters long, slender, with solid, tapering ends and a bispiral or unispiral middle part; spores reddish-brown, finely to coarsely spinose. Sporeling with a globose protomena.

Type species: *Jungermannia scolopendra* W. J. Hooker.

Of the nine species recognized in the genus six are recorded from South America. At least three of the species have an Antarctic distribution and occur also in New Zealand or Australia or Tasmania, and one of them is also found in South Africa.

Key to the Species

1. Stems without paraphyllia.
    2. Leaf segments without laciniae or cilia, entire, ending in a uniseriate hyaline tip to 12 cells long, the end cell to 180 μ, the cuticle striate. 1. *L. scolopendra.*
    2. Leaf segments with scattered laciniae and cilia.

    3. Leaf-segments ending in a usually hyaline uniseriate tip of a few to several long cells. 2. *L. ochroleuca.*
    3. Leaf-segments ending in a few-celled row of short cells which in part soon falls away. 3. *L. rigida.*
1. Stems with paraphyllia.
  2. Leaf segments and margins densely ciliate-laciniate.
    3. Cells with a uniform band of secondary thickening of lighter color; the cell lumina rounded. 6. *L. pruinosa.*
    3. Cells with large trigones and small pits; the cell lumina angular. 5. *L. ramentifissa.*
  2. Leaf-segments without laciniae or cilia, entire; dorsal margin of the lamina with cilia. 4. *L. loriana.*

1. Lepicolea scolopendra (W. J. Hooker) Dumortier, Recueil Obs. Jungerm. 20. 1835.

Jungermania scolopendra W. J. Hooker, Musci Exot. 1: *pl. 40.* 1818.
Schisma scolopendra C. G. Nees ms.
Sendtnera scolopendra C. G. Nees in G. L. & N. Syn. Hep. 241. 1845.
Leperoma scolopendra Mitten in J. D. Hooker, Handb. N. Zeal. Fl. 275. 1867.

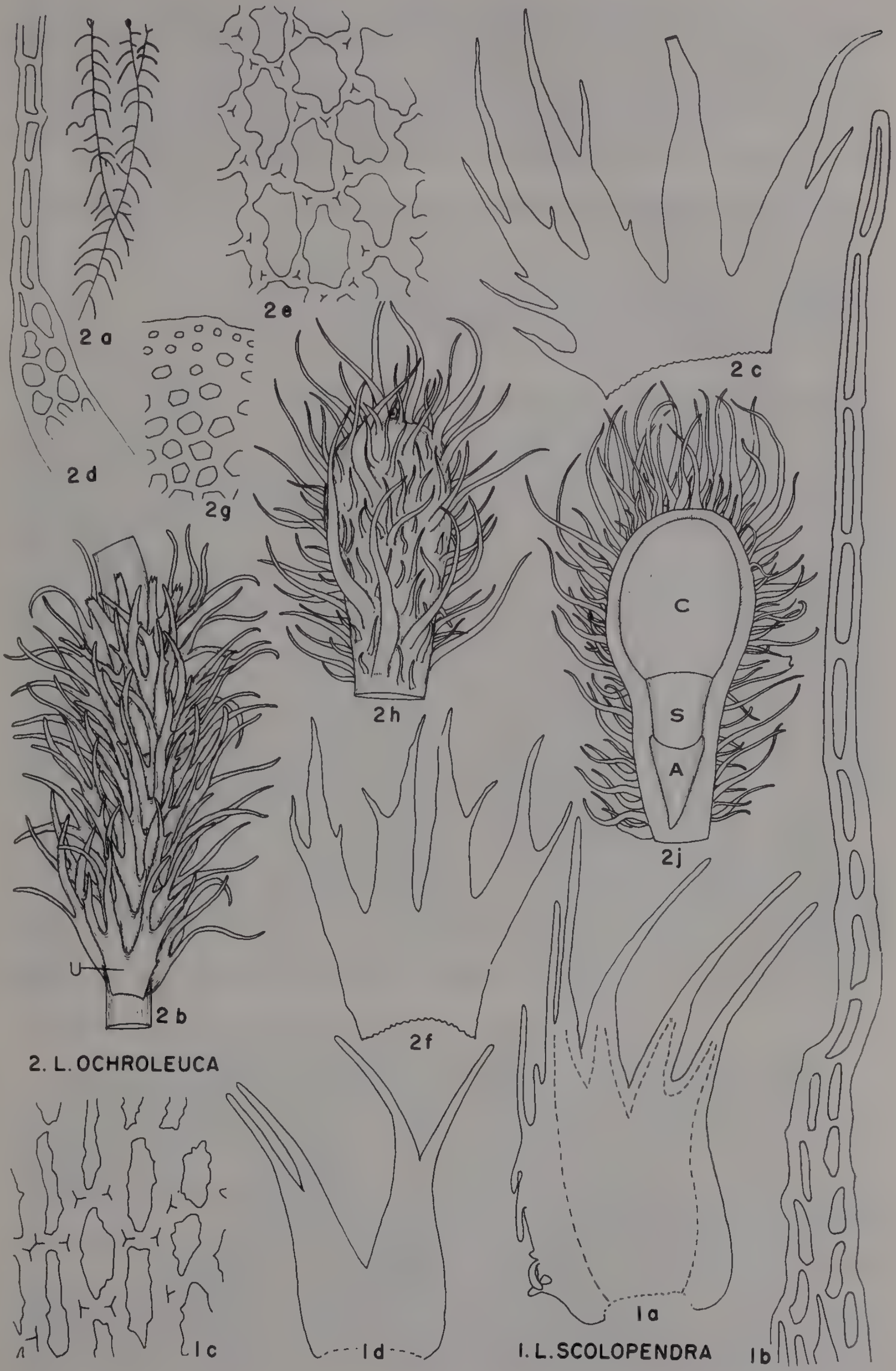
Stems stout, yellow-brown, often hoary, ascending to erect in deep cushions or tufts or pendulous; stems coarse, to 10 cm or more long, with leaves to 2 mm wide, without paraphyllia, regularly pinnate; lateral branches 5 mm or more apart, long, spreading, often becoming attenuate-flagelliform and decurved in the outer part. Rhizoids colorless, on the scales of the flagelliform branches. Line of leaf insertion transverse. Stem leaves large, subrectangular, subsymmetric, to 2.8 mm long, 0.9 mm wide, bisbifid; segments long, lanceolate, without cilia or laciniae, the margins crenulate, ending in a long, hyaline, uniseriate tip, the end cell 140–180 μ long; dorsal margin of the lamina convex, crenulate, with to 12 hyaline cilia, two to ten cells long (in the South American plants), the ventral margin crenulate; cells of the lamina tending to be in rows, those below the segments 40–54 × 18–24 μ, the trigones large, coalesced, the wall thick, wavy, the cuticle striate; a vitta of elongate cells extending from the base up into the segments. Underleaves symmetric, scarcely smaller than the leaves. Branch leaves and underleaves smaller. Plants dioicous. Male inflorescence intercalary on a lateral branch, the bracts and bracteoles in two to sixteen or more series, concave, similar to the branch leaves and underleaves, the margins with more cilia, the bracts pouched, the bracteoles plane; antheridia one or two, large, with paraphyses, in the axils of the bracts. Female bracts and bracteoles larger than the leaves and underleaves, with more cilia; archegonia to 35 or more. Coelocaule large, elongate, club-shaped, densely covered with paraphyllia and scales, bearing unfertilized archegonia at the tip. Elaters long, 12–15 μ wide, bispiral between solid, long-tapering ends; spores 33–37 μ, coarsely spinose. Fig. 1, a–d.

Habitat: On the ground in erect tufts or on trees.

FIG. 1. *Lepicolea scolopendra.* 1 a. Stem leaf, the vitta outlined, × 33. 1 b. Cells of the apex of a leaf, × 180. 1 c. Leaf cells at the base of a segment, × 350. 1 d. Stem underleaf, × 35.

Drawn from the American material.

Fig. 2. *L. ochroleuca.* 2 a. Habit outline of a stem and branches. 2 b. Stem, ventral view, × 16; U, underleaf. 2 c. Stem leaf, × 40. 2 d. Portion of the tip of a leaf segment, × 180. 2 e. Leaf cells just below a segment, × 350. 2 f. Underleaf, × 40. 2 g. Portion of a transverse section of a stem, × 180. 2 h. Surface view of a terminal coelocaule, × 30. 2 j. Longitudinal section through a coelocaule, × 30; A, sporophyte foot; C, capsule; S, seta.


2a
2b
2c
2d
2e
2f
2g
2h
2j
C
S
A
2. L. OCHROLEUCA
1a
1b
1c
1d
1. L. SCOLOPENDRA

The species occurs in New Zealand, Tasmania, Australia and Fiji. There are two packets in the Mitten Herbarium (NY) marked "Island Harbor, Cunningham" which contain plants of this species. One packet contains *L. scolopendra* and *L. rigida,* the latter a species limited to South America, in equal amounts, while the other contains a great amount of *L. scolopendra* and several stems of *L. loriana*, a species known otherwise only from the Pacific. To my knowledge there have been no other collections reported from South America.

2. **Lepicolea ochroleuca** (K. Spengel) Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 345. 1885.

Jungermannia ochroleuca K. Sprengel, Syst. 4^2: 325. 1827.
Sendtnera ochroleuca C. G. Nees in G. L. & N. Syn. Hep. 240. 1845.
Sendtnera ochroleuca β mexicana Gottsche, Mex. Leberm. 140. 1863.
Leperoma ochroleuca Mitten in J. D. Hooker, Handb. N. Zeal. Fl. 754. 1867.
Herbertia ochroleuca Trevisan, Mem. Ist. Lomb. III. 4: 397. 1877.

Plants large, yellow to golden-brown or dark brown, ascending to erect in large, deep cushions; stems rigid, to 14 cm long, with leaves to 5 mm wide, without paraphyllia, regularly pinnate, the lateral branches simple, widely spreading, often becoming attenuate-flagelliform, decurved in the outer part. Stem leaves subsymmetric, 0.5–1.5 mm long, 0.3–0.7 mm wide, cuneate, bisbifid; segments lanceolate, the margins with a few long, slender teeth and cilia, crenulate, the tips attenuate, ending in a uniseriate row of to twelve cells which become increasingly longer to the tip cell, hyaline in part; dorsal margin of the lamina with a few long teeth and cilia, the ventral margin not divided, crenulate; cells of the lamina tending to be in rows, below the segments averaging $27–36 \times 18–22\,\mu$, the walls thickened, with large trigones and thin pits, the cell lumina angular, the cuticle verruculose. Underleaves symmetric, similar to the leaves, scarcely smaller. Plants dioicous. Male inflorescence intercalary on a vegetative branch, the bracts and bracteoles in sixteen or more series, the bracts less divided and with more cilia than the leaves, concave; antheridia large, one or two in the axils of the bracts; paraphyses absent. Female bracts and bracteoles similar to the leaves and underleaves, larger; archegonia twelve or more. Coelocaule elongate, club-shaped, densely covered with paraphyllia and scales (fragments of the bracts and bracteoles), the unfertilized archegonia at the tip, fleshy, the wall thick, closely adhering to the young sporophyte. Mature sporophyte, spores, and elaters not seen. Fig. 2, a–j.

Habitat: On the ground, over rocks and on trunks of trees, forming spongy cushions with other bryophytes.

MEXICO: s.l., without collector's name, as *L. ochroleuca β mexicana* (NY).

GUATEMALA: El Progreso, near Volcán Santa Louisa, *Steyermark 43528* (F).

HONDURAS: Morazán, Cerro Uyuca, 1600–1800 m. *Standley 705, 721, 8040 p.p.* (F).

PATAGONIA—TIERRA DEL FUEGO: Corral, *Thaxter 117* p.p. (MICH); Valdivia, *Hahn* (G); Chiloe I., *Cuming 144* (NY); Lake Nahuel Huapí, *Dusén 524* (NY); Guaitecas I., *Dusén 366* (NY); Lake Llanquihué, *Dusén 415* (NY); Aysen, River, *Dusén 336* (G); Halt Bay, *Cunningham* (NY); Sholl Bay, *Cunningham 239* (NY); Port Gallant, *Cunningham* (NY); York Bay, *Lechler* (NY); s.l., *Lechler* (NY); Desolation I: Puerto Angosta, *Dusén 276* (NY); Hermite I., *Hooker* (NY); Cape Horn, *Hooker* (NY).

JUAN FERNANDEZ: Masafuera: Las Torres, *Skottsberg 201,* (as *L. ochroleuca* var. *seriata*) (NY); Masatierra: Torbezuelo de Villagra, *Skottsberg 207* (NY).

The species has also been reported in the following papers: Bolivia (Pearson, 1890; Spruce, 1890), Chile (Evans, 1892; Hampe, 1854; Herzog, 1921, 1923, 1939b, 1954; Massalongo, 1927; Montagne, 1848, 1852; Müller, 1955; Reimers, 1926; Stephani, 1900 a, b, 1901 a, 1902, 1903a, 1911). Juan Fernandez (Herzog, 1942a), Argentina (Kühnemann, 1949; Müller, 1955) and Tierra de Fuego (Gola, 1923).

The species is also known from several localities in southern Africa.

3. **Lepicolea rigida** (de Notaris) E. Scott, Nova Hedwigia **2**: 148. *f. 20–39.* 1960.

Sendtnera rigida de Notaris, Mem. Accad. Sci. Torino II. 16: 229. *pl. 15.* 1857.
Herbertia rigida (de Notaris) Trevisan, Mem. Ist. Lomb. III. 4: 397. 1877.
Leperoma rigida (de Notaris) Massolongo, Nuovo Gior. Bot. Ital. 17: 253. 1885.
Lepicolea seriata Herzog, Hedwigia 66: 91. *f. 8.* 1926.
Lepicolea ochroleuca var. *seriata* Herzog, Nat. Hist. Juan Fernandez & Easter Isl. Botany 2: 728. 1943.

Plants large, rigid, dull brown becoming blackish, ascending to erect, in deep cushions or among other bryophytes; stems rigid, 6–10 cm long, with leaves to 1.0 mm or more wide, without paraphyllia, regularly pinnate (occasionally bipinnate), the lateral branches frequent, often becoming attenuate- flagelliform with decurved tips. Line of leaf insertion transverse. Stem leaves subsymmetric, rectangular, to 1.6 mm long, 0.6 mm wide, usually bisbifid; segments lanceolate, sparingly laciniate, the tip attenuate, ending in a uniseriate row of four to eight short, rectangular cells and a slime papilla, in part caducous; dorsal margin of the lamina with occasional teeth and cilia, the ventral margin mostly entire, crenulate; leaf-cells tending to be in rows, those just below the segment 27–45 × 20–24 μ, the walls thickened, trigones and pits frequent, an additional uneven layer of thickening also present, forming an irregular band within the cell, the cell lumina rounded, the cuticle verruculose to striolate; a well-marked vitta extending from the base up into the segments. Underleaves symmetric, similar to the leaves or scarcely smaller. Plants dioicous. Male inflorescence on a lateral vegetative branch, the bracts and bracteoles in to 30 or more series, similar to the branch leaves and underleaves, the bracts concave; antheridia large, globose, one or two in the axils of the bracts. Female inflorescence terminal on the stem or a leading branch, the bracts and bracteoles similar to the leaves, larger; archegonia 12 or more. Coelocaule large, club-shaped, covered with paraphyllia and branched, lanceolate scales, the unfertilized archegonia at the tip. Mature sporophyte, spores and elaters not seen. Fig. 3, a–d.

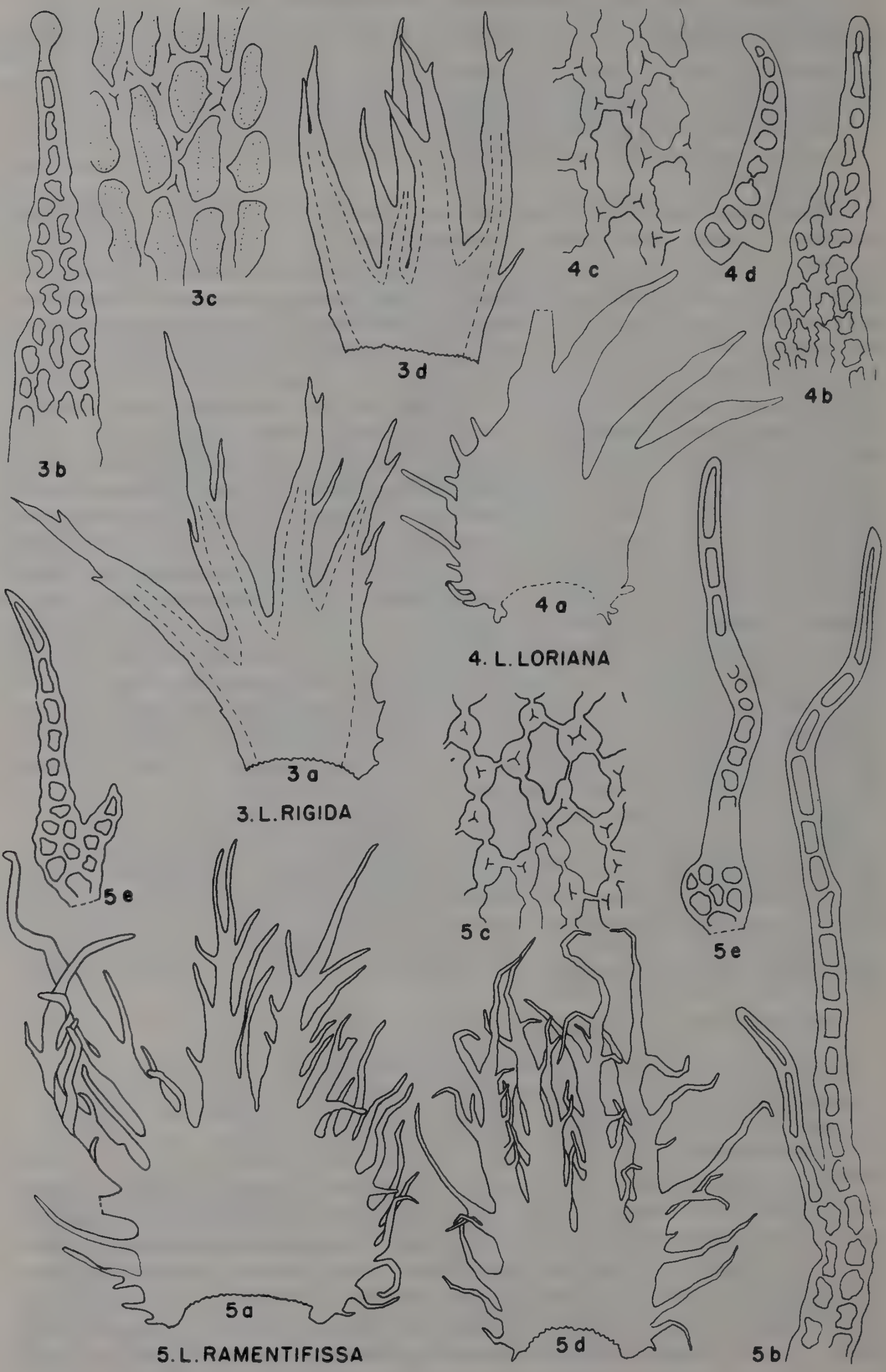
Habitat: In wet places among mosses and over rocks and rock ledges.

PATAGONIA—TIERRA DEL FUEGO: Valparaiso, without collector's name, [isotype ?] (NY); Punta Leopardo, *Reichert & Hicken*, the type of *L. seriata* (Hb. Herzog); Straits of Magellan, *Pillwax* (NY), *Dow* (NY); Newton I., *Dusén* (as *L. ochroleuca*) (NY); Island Harbor, *Cunningham* (N.Y); Port Gallant, *Cunningham 256, 261* (NY); Villarino Bay, *J. Hatcher 3, 13* (NY); Lapataia, *J. Hatcher* (NY); s.l., *J. Hatcher 12, 13, 17, 19, 33b, 34, 42* (NY); Smyth Channel, *Gusinde 3697* (NY); Hermite I., *Hooker* (NY); Cape Horn, *Hooker* (NY); Staten I., *Spegazzini 37* (NY).

4. **Lepicolea loriana** Stephani, Spec. Hep. **6**: 363. 1922.

Jungermannia ochroleuca var. *tenerior* C. G. Nees, Hep. Jav. 17. 1830.
Jungermannia ochroleuca nana C. G. Nees, Hep. Jav. 17. 1830.
Sendtnera ochroleuca tenerior C. G. Nees in G. L. & N. Syn. Hep. 240. 1845.
Sendtnera nana C. G. Nees in G. L. & N. Syn. Hep. 240. 1845
Lepicolea simplicior Herzog, Ann. Bryol. 5: 81. *f. 3, c–d.* 1932.

Plants large, yellowish-brown, erect or ascending, in cushions. Stems coarse, to 10 cm long, with leaves to 2 mm wide, with scattered filamentous paraphyllia, pinnate; lateral branches simple, widely spreading, decurved in the outer part, usually becoming attenuate or flagelliform. Stem leaves asymmetric, ovate-rectangular in outline, 1.9 mm long, 0.9 mm wide, bisbifid to the middle; segments undivided, with crenulate margins, the apex tapered to a uniseriate point of four to eight cells, only one to three of the cells longer than the others; dorsal margin of the lamina strongly convex and bearing numerous cilia with long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5c
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5a
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5b

3. L. RIGIDA

4. L. LORIANA

5. L. RAMENTIFISSA

hyaline tips, the ventral margin straight, crenulate or with a few cilia near the base; cells of the lamina tending to be in rows, those just below a segment averaging 30–36 × 27 μ, the trigones large, the walls thick, uneven, with thinner-walled pits, the cell lumina angular, the cuticle verruculose to striolate. Underleaves symmetric, similar to but slightly smaller than the leaves, the margins coarsely crenulate, with short cilia only near the base, or absent. Sexual branches and sporophyte not seen. Fig. 4, a–d.

Habitat: On logs.

The species is abundant and widespread in the Pacific area. There are a few stems mixed with *L. scolopendra* in a packet in the Mitten Herbarium (NY) labeled "Island Harbor, Cunningham." It is assumed that this was collected in Chile.

5. **Lepicolea ramentifissa** Herzog, Bibliot. Bot. **31**(88): 30. *f. 17.* 1920.

Plants large, golden-brown, erect or ascending, in tufts or cushions; stems stout, to 10 cm or more long, with leaves to 2 mm wide, with abundant, long, filamentous paraphyllia, pinnate to bipinnate, the lateral branches numerous, tending to become attenuate-flagelliform, decurved at the tips. Line of the leaf insertion transverse. Stem-leaves subsymmetric, rectangular, mostly 2.3 mm long, 1.2 mm or more wide, quadrifid, usually bisbifid to one-half of their length; segments lanceolate, long, laciniate, long-ciliate, crenulate, attenuate, ending in a uniseriate tip of ten or more cells; margins of the lamina densely laciniate and ciliate; cells tending to be in rows, those just below the segments averaging 36–40 × 22 μ, the trigones large, the walls thick with frequent thin-walled pits, the cell lumina angular, the cuticle verruculose to striolate. Underleaves symmetric, similar to the leaves, scarcely smaller. Sexual branches and sporophyte not seen. Fig. 5, a–e.

Habitat: On trees.

BOLIVIA: Comarapa, *Herzog* (type Tb. Herzog); Ceja de Negracota, Tröll (Hb. Herzog).

This species has also been reported from Costa Rica by Herzog (1938a).

6. **Lepicolea pruinosa** (T. Taylor) Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 345. 1885.

Sendtnera pruinosa T. Taylor, London Jour. Bot. 5: 373. 1846.
Sendtnera aequalibis T. Taylor, London Jour. Bot. 5: 372. 1846.
Lepidozia columbica de Notaris, Mem. Acad. Sci. Torino II. 16: 224. *f. 13.* 1857.
Sendtnera pruinosa var. *aequalibis* (T. Taylor) Spruce, Trans. Proc. Bot. Soc. Edinb 15: 346. 1885.
Lepicolea herzogiana Stephani, Bibliot. Bot. 31(87): 229. *f. 172.* 1916.

Plants large, yellow-brown, often becoming darker to reddish, sometimes hoary at the base, erect to pendulous, in large tufts or cushions; stems stout, to 10 cm long, with leaves to 2.5 mm wide, with abundant filamentous stem para-

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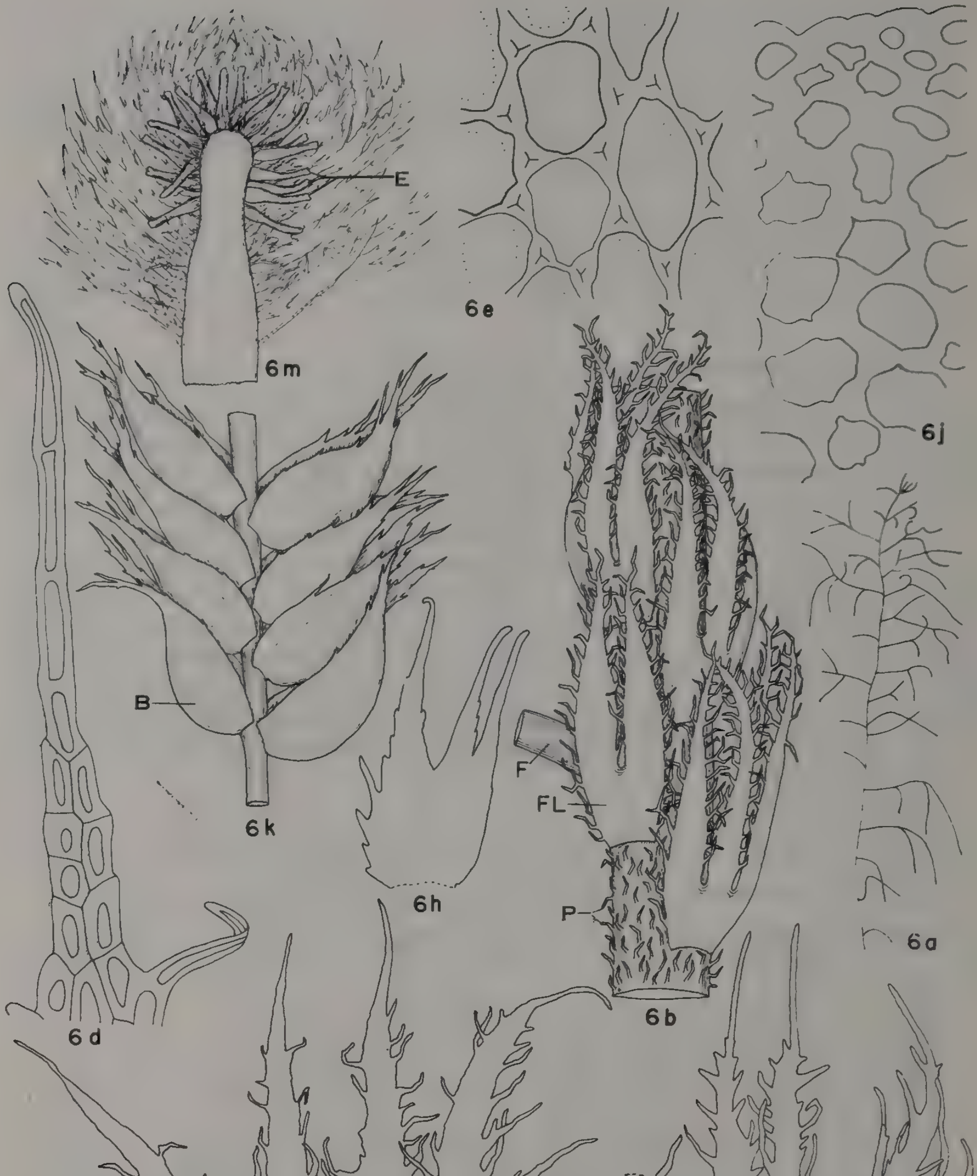
FIG. 3. *Lepicolea rigida*. 3. a. Stem leaf, × 40; area of the vitta outlined. 3 b. Tip of a leaf segment, × 180. 3 c. Leaf cells just below a segment, × 350. 3 d. Stem underleaf, × 40.

FIG. 4. *L. loriana.* 4 a. Stem leaf, × 40. 4 b. Tip of a leaf segment, × 180. 4 c. Leaf cells just below a segment, × 350. 4 d. One of the stem paraphyllia.

Drawn from the American material.

FIG. 5. *L. ramentifissa.* 5 a. Stem leaf, × 33. 5 b. Tip of a leaf segment, × 180. 5 c. Cells of the leaf just below a segment, × 180. 5 d. Stem underleaf, × 33. 5 e. Stem paraphyllia, × 180.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6. L. PRUINOSA

phyllia with hyaline tips, regularly bipinnate; lateral branches mostly 5 cm apart, long, often branched, leafy, becoming attenuate with smaller leaves and underleaves with fewer cilia and laciniae and one less segment, often flagelliform and curved downward in the outer part; stem in transverse section with one to three layers of small cells with very thick, brownish walls surrounding the many larger thick-walled cells of the medulla. Line of leaf insertion transverse. Stem-leaves subsymmetric, short rectangular, mostly 2 mm long, 1.5 mm wide, bisbifid to one-half of their length; segments long-lanceolate, laciniate-ciliate, ending in a long, often hyaline tip three to five long cells; margins of the lamina densely ciliate, laciniate and crenulate to the base; cells tending to be in rows, those just below a segment 40–60 × 36 μ, the trigones large, conspicuous, the pits thin-walled, the cells with an additional deposit of material around the wall, the cell lumina rounded, the cuticle coarsely verruculose. Underleaves similar to the leaves, symmetric, scarcely smaller. Plants dioicous. Male inflorescence on a lateral vegetative branch, the bracts and bracteoles in four or five series, the bracts pouched, the bracteoles plane; antheridia one or two in the axils of the bracts. Female inflorescence terminal on the stem or a leading branch, the bracts and bracteoles similar to the leaves; archegonia produced in very great numbers over the tip of the stem among the bracts and bracteoles (scales) and paraphyllia, large, tubular, the neck in transverse section of two rings of cells, eight inner cells, from fourteen to sixteen outer cells. Sporophyte developed within a coelocaule (only the very early stages seen. Fig. 6, a–m.

Habitat: On trees, hanging from branches, and on rocks and soil or among mosses.

COSTA RICA: San José. n of El Copey, 2100–2400 m, *Standley 42594* (F).

COLOMBIA: Cauca: Páramo de Las Papas, *Bischler 706* (♀), *880, 887* (COL); Cauca: Cordillera Central, quebrada del río San Marcos, 2700–2900 m, *Cuatrecasas 14783 B* (US); Dept. de Valle: Cordillera Occidental, Los Farollones, 3500–3600 m, *Cuatrecasas 17939 B p.p.* (US); Rio Napo, *Osculati*, isotype of *Lepidozia columbica* (G); Páramo do Sónson, 10,000, *Wallis* (G).

VENEZUELA: Sierra Nevada above Meridá, *Alston 6915, 6921, 6921A* (BM).

ECUADOR: Quito, *Jameson* (NY), *Jameson 119* (BM); Pichincha woods, *Jameson 337*, type of *L. aequiloba* (NY); Canelos, *Spruce, Hep. Spruce* (G, NY); Azuay: Río Patul, 2670–3275 m, *Steyermark 52645* (F); Río Collay, s of El Pan, 2650–3290 m, *Steyermark 53364* (♂) (F); Tungurahua, 2500 m, *Spruce* (MANCH-Kk 854, NY).

PERU: Cuzco: La Convención, *Bues 1183b* (NY).

BOLIVIA: Tolapampa, 10,000 ft., *Williams 2155* (NY); Unduavi 10,400 ft., *Brooks 6835* (NY); s.l., *Herzog*, type of *L. herzogiana* (G).

CHILE: s.l., *Lechler 3102*, (as *S. ochroleuca*) (NY).

The species has also been reported in the following papers: Costa Rica (Herzog, 1938a), Ecuador (Herzog, 1952a, 1957a), Peru (Jack & Stephani, 1892) and Bolivia (Herzog, 1916, 1920).

Taxa not studied

Sendtnera ochroleuca piligera de Notaris, 1857, Valparaiso, Chile.

References

Scott, Edith. 1960. A monograph of the genus *Lepicolea* (Hepaticae). Nova Hedwigia 2: 129–172. *pl. 1–21.*

FIG. 6. *Lepicolea pruinosa.* 6 a. Habit of plant to show type of branching. 6 b. Leafy stem, dorsal view, × 33; F, branch of the *Frullania* type; FL, half-leaf with this branch; P, stem paraphyllia. 6 c. Stem leaf, × 33. 6 d. Tip of a leaf segment, × 180. 6 e. Leaf cells just below a segment, × 350. 6 f. Stem underleaf, × 33. 6 g. Stem paraphyllia, × 180. 6 h. Branch leaf, × 33. 6 j. Portion of a transverse section of a stem, × 350. 6 k. Male inflorescence, dorsal view, × 40; B, bract. 6 m. Longitudinal section through a young female inflorescence, × 40; E, archegonia.

Drawn from the isotypes.

TRICHOCOLEACEAE Nakai [A list of professor Nakai's papers . . . science] 200. 1943.

Ptilidiaceae auctt. p. p.

Stems simple, bi- or tripinnate, the branches lateral, of the *Frullania* type, and as subfloral innovations. Rhizoids in tufts, from the lamina of the underleaves, rarely on the male bracteoles, often from a one-layer rhizoid pad. Line of leaf insertion transverse, or oblique with the leaves succubous. Leaves (3–) 4–6–9-parted to one-half of their length or more; segments simple, or branched with few to many long, simple or branched cilia, occurring singly, in opposite pairs, or in whorls. Underleaves large, quadrifid, or with additional smaller segments, often bisbifid to one-half of their length or more, the segments like the leaf-segments. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts and bracteoles similar to and larger than the leaves and underleaves or more elaborate; antheridia large, in the axils of the bracts. Female inflorescence terminal on the stem or a branch, without or with one or two subfloral innovations, the bracts and bracteoles in several series, similar to the leaves and underleaves, or often more elaborate. Sporophyte covered by a shoot-calyptra and a perianth, or a partial coelocaule capped by a short perianth above the level of the capsule, or a thick, fleshy coelocaule covered with scales and paraphyllia, the unfertilized archegonia at the tip, with no indication of a perianth. Capsule wall thick, of four to seven layers, the outermost layer of large cells, the other layers of smaller cells.

Type genus: *Trichocolea* Dumortier, corr C. G. Nees.

The members of this family are found primarily in the Southern Hemisphere. The family is of special significance because of the two major evolutionary tendencies that it exhibits. In *Trichocolea* there are only minor differences among the species in vegetative characters, such as stem, leaves, and underleaves; the major changes have come in the shoot/sporophyte relationship. There are, at the present time, three distinct types: a perianth enclosing a shoot-calyptra; a partial coelocaule with a small perianth at the top; and a thick coelocaule with unfertilized archegonia at the tip. In the other genus of the family, *Temnoma,* the sporophyte/shoot relationship has remained essentially unchanged, a simple three-keeled perianth, while the leafy stems have undergone drastic reductions. The principal changes have been a decrease in the size of the plants, and a reduction in size and number or a loss of cilia on the leaves and underleaves. The female bracts and bracteoles of even the most simplified of the species have retained the cilia to a greater or lesser degree.

Trichocolea Dumortier, corr. C. G. Nees, Nat. Eur. Leberm. **3**: 103. 1838.

Thricholea Dumortier, Comm. Bot. 113. 1822.
Tricholea Dumortier, Anal. Fam. 69. 1829. Nomen nudum.
Thricolea Dumortier, Syllog. Jungerm. 24, 28, 66. 1831.
Leiomitra Lindberg, Acta Soc. Sci. Fenn. **10**: 515. 1875.
Basichiton Trevisan, Mem. Ist Lomb. **13**: 394. 1877.

Plants in mats, tufts or scattered among other bryophytes, prostrate to suberect, whitish-green to yellowish-green; stems simple to bi- or tripinnate, the branches lateral, of the *Frullania* type, with the dorsal half-leaf at the base of the branch; stems in transverse section with a cortical band of one to several layers of somewhat smaller cells surrounding the many large cells of the medulla; stem with or without filamentous paraphyllia. Rhizoids when present from a unistratose rhizoid pad on the lamina of the underleaf or occasionally on the male bracteole, the tips expanded as disc-shaped plates, sometimes fused. Line of leaf insertion oblique, the leaves succubous. Leaves subquadrate to ovate or broadly orbicular, symmetric or asymmetric, with the ventral portion longer, divided into three to nine triangular, often branched, ciliate segments, the cilia occurring singly and opposite or whorled, the cells long, narrow, the cuticle striolate-papillose, the lamina quadrate, rectangular, or irregular in outline, occasionally with superficial cilia over the surface. Underleaves transversely inserted, a little smaller to only one-half as wide as the leaves, bisbifid or quadrifid to one-half or more of their length, the four segments branched and ciliate as in the leaves. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts and bracteoles in to 15 or more series, as large as or larger than the leaves, the bracts concave, the lamina long, the cilia shorter than those on the leaf; antheridia large, globose, one or two in the axils of the bracts, the stalk long. Female inflorescences terminal on a stem or branch, becoming lateral or axillary through the development of one or two lateral subfloral innovations which may in turn become floriferous, the bracts and bracteoles similar to but more elaborate than the leaves and underleaves, in three series, the inner series the largest and larger than the leaves; archegonia 8–20 or more, surrounded by many paraphyllia. Perianth present or absent. Sporophyte enclosed in a shoot-calyptra and perianth (*T. tomentosa*); or a coelocaule (formed of the shoot and calyptra) either incomplete, a cryptocoelocaule, with a thickened hollow stem below and a very small shoot-calyptra surrounded by a very short perianth at the top, or complete, an epicoelocaule, covered with paraphyllia, scales, and with unfertilized archegonia at the top. The sporophyte foot inverted cone-shaped with a high collar; seta in transverse section of small firm-walled outer cells surrounding the larger delicate-walled inner cells which soon disintegrate. Capsule oblong, the wall of six or seven layers of cells, the cells of the outer layer large, thin-walled, soon disappearing, the cells of the inner layers smaller, with rod-shaped, reddish-brown thickenings on the tangential walls; elaters long slender, reddish-brown, with two or three spirals, the ends blunt or tapering; spores 30–35 μ, reddish-brown. Protonema of the *Nardia* type. Gemmae not seen.

Type species: *Jungermannia tomentella* Ehrhart, Beitr. Naturk. **2**: 150. 1788.

The genus, with some twenty species, is mainly in the Southern Hemisphere. Only one species is found in North America and it does not extend into the Southern Hemisphere. From a developmental point of view the genus is of interest in that there are three types of shoot-sporophyte relationships developed among species which are otherwise very similar.

Key to the Species

1. Leafy stems with few to many paraphyllia.
  2. Leaves divided to one-half of their length into six or eight very densely ciliate segments. 4. *T. robusta.*
  2. Leaves divided to one-half of their length into four or five sparsely ciliate segments. 5. *T. paraphyllina.*
1. Stems without paraphyllia.
  2. Plants very small, filiform; leaves with only three segments. 12. *T. filicaulis.*
  2. Plants larger; leaves with more than three segments.
    3. Leaf lamina less than half as high as wide, mostly only one to three cells high.
      4. Plants small; leaves approximate to spreading.
        5. Cells of the leaf lamina mostly 55 × 18 μ. 10. *T. floccosa.*
        5. Cells of the leaf lamina mostly 90 × 30 μ. 11. *T. sprucei.*
      4. Plants large; leaves imbricate, appressed.

5. Leaves with a long, decurrent, dorsal line of insertion 2. *T. uleana.*

5. Leaves with a short dorsal line of insertion; cilia long, slender, abundant, tending to be parallel to the stem. 1. *T. tomentosa*

3. Leaf lamina at least half as high as wide, mostly five or more cells high.

4. Lamina of the leaf with scattered superficial cilia. 9. *T. argentea.*

4. Lamina of the leaf without superficial cilia.

5. Some of the divisions of the leaf-segments recurved. 6. *T. elegans.*

5. None of the divisions of the leaf segments recurved.

6. Lamina of the leaf 8 to 14 cells high, not distinctly wider than high. 7. *T. brevifissa.*

6. Lamina of the leaf five or six cells high, distinctly wider than high.

7. Plants of small to medium size; leaves divided to two-thirds of their length into four or five mostly sparsely ciliate segments; leaves never decurrent. 8. *T. flaccida.*

7. Plants of medium to large size; leaves divided to one-half of their length into five or six densely ciliate segments; leaves often a little decurrent. 3. *T. elliottii.*

1. Trichocolea tomentosa (Swartz) Gottsche, Mexikanske Levermosser 119. 1863. (Danske Vid. Selsk. Skr. V. Naturr. Math. **6**: 215. 1867.)

Jungermannia tomentosa Swartz, Prod. 145. 1788.
Basichiton tomentosum Trevisan, Mem. Ist. Lomb. III. 4: 394. 1877.
Leiomitra sphagnoides Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 350. 1885.
Trichocolea sphagnoides Stephani, Trans. Linn. Soc. II. Bot. **6**: 99. 1901.
Leiomitra crista-castensis Spruce ms. *Hepat. Spruc.*
Trichocolea mexicana Stephani, Spec. Hep. **4**: 54. 1909.
Trichocolea grandifolia Stephani, Spec. Hep. **4**: 55. 1909.
Trichocolea cristacastrensis Stephani, Spec. Hep. **4**: 59. 1909.
Trichocolea allioni Stephani, Spec. Hep. **6**: 372. 1924.
Trichocolea pterophylla Herzog, Hedwigia **67**: 250. 1927.

Plants long, large, in pale greenish-yellow tufts; stems stout, 10–20 cm long, with leaves to 1.5 mm wide, pinnate or rarely bipinnate, the branches mostly 1 cm long, becoming recurved above; stems in transverse section 21–26 cells across, the cortex of smaller cells in one or two layers; stem paraphyllia absent. Line of leaf insertion oblique, the dorsal part short, the leaves succubous. Leaves appressed, closely imbricate, asymmetric, to 1 mm long, 1–4 mm wide, divided to near the base into five to eight unequal, often divided, ciliate segments; lamina one to three cells high, the cells of the dorsal part $31 \times 35\,\mu$, those of the ventral half $73 \times 12\,\mu$; segments often branched, narrowly triangular, densely ciliate with great numbers of long, simple or branched cilia tending to be parallel to the stem, the cells long, the cuticle striolate-papillose. Underleaves symmetric, half as wide as the leaves, bifid nearly to the base, the halves again divided, forming usually four often branched segments, ciliate as in the leaf. Plants dioicous. Male inflorescence intercalary on a branch, the bracts and bracteoles in six or more series, the bracts similar to the leaves but concave and

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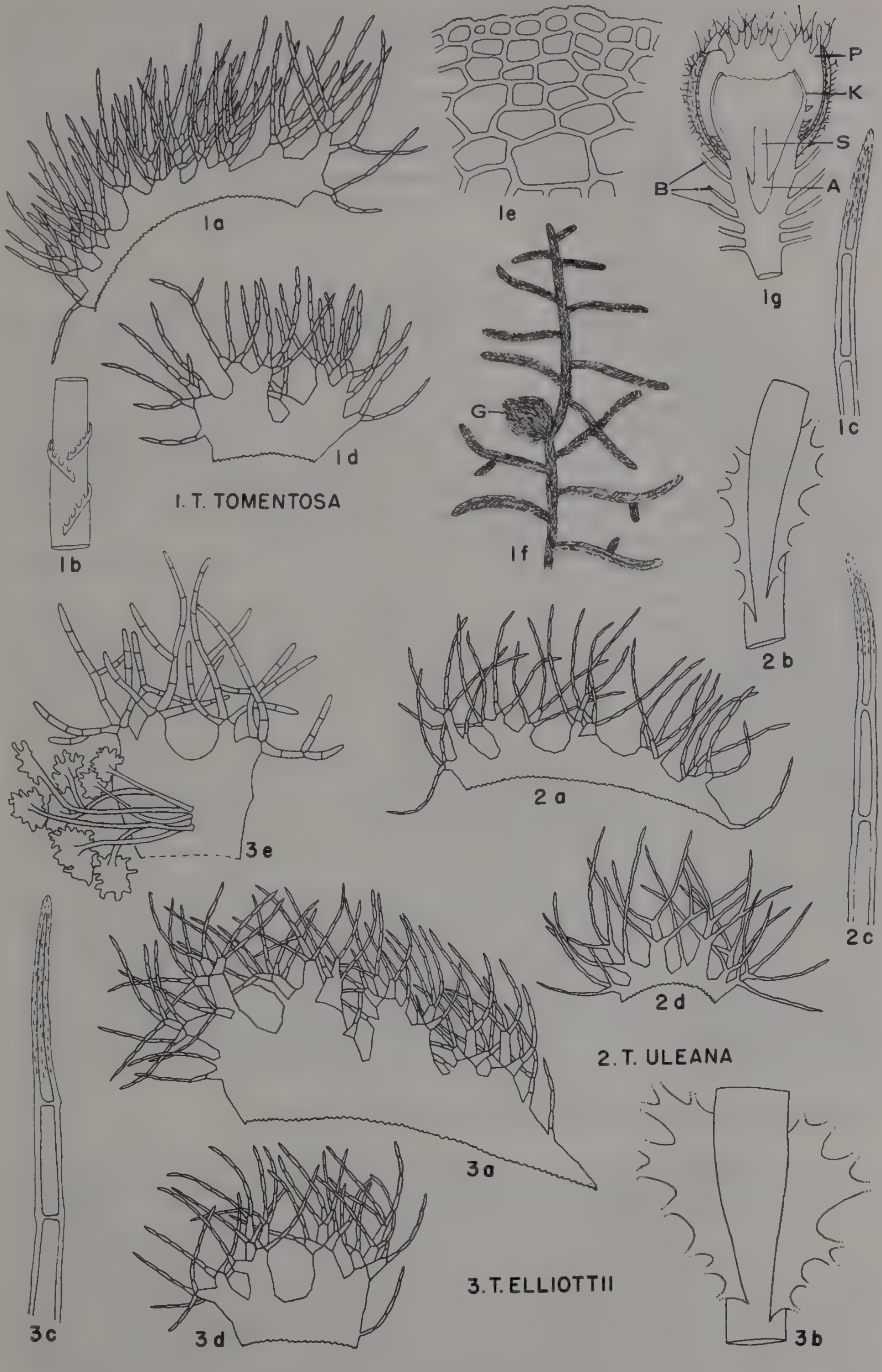
FIG. 1. *Trichocolea tomentosa.* 1 a. Stem leaf, × 55. 1 b. Stem showing leaf insertion, × 10. 1 c. Portion of one of the cilia, × 235. 1 d. Stem underleaf, × 55. 1. e. Portion of a transverse section of a stem, × 235. 1 f. Habit of the plant; G, female inflorescence. 1 g. Longitudinal section through the tip of a female stem on which a sporophyte has developed, × 10; A, foot of sporophyte; B, three female bracts; K, shoot-calyptra; P, perianth, covered with paraphyllia; S, seta of the sporophyte.

FIG. 2. *T. uleana.* 2 a. Stem leaf, × 55. 2 b. Stem showing leaf insertion, dorsal view, × 12. 2 c. Portion of one of the cilia of a leaf, × 235. 2 d. Stem underleaf, × 55.

FIG 3. *T. elliottii.* 3 a. Stem leaf, × 55. 3 b. Stem showing leaf insertion, dorsal view, × 15. 3 c. Portion of one of the cilia of a leaf, × 235. 3 d. Stem underleaf, × 55. 3 e. Male bracteole showing tuft of rhizoids with expanded tips, × 55.

Drawn from Hatcher, 1957, 1959.


1a
1e
P
K
S
B
A
1g
1c
1d
G
1. T. TOMENTOSA
1b
1f
2b
3e
2a
2c
2d
2. T. ULEANA
3a
3c
3d
3. T. ELLIOTTII
3b

with a broader lamina; antheridia solitary, large, globose. Female inflorescence terminal on the stem or a branch, with one subfloral innovation, the bracts and bracteoles symmetric, larger than the leaves and underleaves, in three series, the bracts to 2 mm long, 1.7 mm wide, divided to one-half of their length into six or eight or more segments, ciliate as in the leaves, the lamina with scattered superficial cilia. Perianth large, inflated, the surface covered with paraphyllia, the mouth broad, of many narrow segments bearing long cilia. Shoot/sporophyte relationship a shoot-calyptra with unfertilized archegonia up the sides of the "calyptra." Fig. 1, a–g.

Habitat: Over the ground and on trunks of trees.

CUBA: Oriente: crest of Sierra Maestra, *Morton 9244, 9524, 9626* (US).

JAMAICA: s.l., *Swartz*, (type S-PA); s.l., *Wills 2* p.p., *3* (BM); Hardwar Gap, *Baxter 4* (KANU), *M. Farr 861* (IJ); Hardwar Gap to Waterfall, *Porter 366* (IJ); near Mt. Airy, *M. Farr 808* (IJ); se slope of Stone Hole Bumps, 600–800 m, *Maxon 9004* (US); Morce's Gap, *Patterson* (Hb Fulford).

TRINIDAD: Maraccas Mountains, *Crüger* (NY).

MEXICO: Puebla: El Cerro Cahuatepec, 3500 ft, *Sharp 1399* (TENN); Cafetal, *Karsten* type of *T. mexicana* (G); slopes of El Cerro de Cuguatepetl, *Santos 3640* (Hb. Fulford).

GUATEMALA: Alta Verapaz near Cobán, *Türkheim 5810* (as *T. mexicana*) (G); Dep. Quezaltenango: Fuentes Georginas, 2300–2500 m, *Standley 85862, 86002* (F); Alta Verapaz near Cubilqüitz, *Steyermark 44482* (F); El Progreso, near Volcán Santa Luisa, *Steyermark 43528* p.p. (F); Huehuetenango, Cerro Huetz, *Steyermark 47415* (F).

COSTA RICA: near La Palma, *Maxon* (NY); s.l., *Brenes 19136* (Hb. Fulford); Santa Clara: Cartago, *Torres 213* p.p. (F).

PANAMA: Chirique: near El Hato, *Stern & Chambers 68* (Y).

COLOMBIA: Bogotá, Weir (NY); Cauca: Cordillera Central, Quebrada del Río López, *Cuatrecasas 18921* (US).

VENEZUELA: near Mérida, *Alston 6920 B* (BM); Estado Bolívar: Chimantá Massif, Abacapá-tepuí, *Steyermark 75025 p.p.* (F).

BRITISH GUIANA: Mt. Roraima, *Ule 624* (as *T. allionii*) (G); s.l., *Quelch*, type of *T. grandifolia* (G).

BRAZIL: S. Catarina: Morro de Bateia Brusque, 360 m, *Reitz 1933* (HBR); Alto da Serra, *Hoehne 535*, type of *T. pterophylla* (Hb. Herzog).

ECUADOR: Rosario, *Allioni 6642*, type of *T. allionii* (G); Mt. Tungurahua, *Spruce*, isotype of *L. cristacastrensis* (NY); Spruce, *Hepat. Spruc*, isotype of *L. sphagnoides* (NY); Canelos, *Spruce, Hepat. Spruc.* (as *L. tomentosa var. canelensis* p.p.) (NY); Chirimoyga, *Bell 302B* (BM); s.l. *Fraser 16* p.p. (BM).

BOLIVIA: Incachaca, *Brooke 6811* (BM); s.l., *Herzog 4553* (as *T. allioni*) (G).

The species has also been reported in the following, Cuba (Welch, 1950) Jamaica (Pearson, 1931), Puerto Rico (Pagán, 1939); Guadeloupe: (Bescherelle, 1893; Jovet-Ast, 1947, 1960; Stephani, 1904), Dominica (Spruce, 1889, 1895; Pagán, 1942; Pearson, 1922), Mexico (Gottsche, 1863); Costa Rica (Haupt, 1942; Herzog, 1938a), Colombia (Gottsche, 1864), British Guiana (Stephani, 1901c), Argentina (Kühnemann, 1949), Magellan Straits—Tierra del Fuego; Angström, 1876; Massalongo, 1885, 1927; Schiffner, 1889; Spegazzini, 1922). With the distribution data and the many collections which are now available, it would seem that the reports from the tip of South America should belong to another species.

2. **Trichocolea uleana** Stephani, Spec. Hep. **4**: 55. 1909.

Plants of medium size, in pale yellowish-green tufts; stems to 5 cm long, with leaves to 1 mm wide, pinnate to irregularly bipinnate, the branches mostly 3–4 cm long; stems in transverse section 10–12 cells across, the unistratose cortex of smaller cells than those of the medulla; stem paraphyllia absent. Line of leaf insertion oblique, the dorsal portion very long, the leaves succubous. Leaves imbricate, asymmetric, decurrent, to 0.8 mm long, 1.3 mm wide, divided to near the base into five or six unequal, branched, triangular segments, ciliate with a few long, usually simple cilia with cells averaging 92 × 13 μ, the cuticle striolate-papillose; lamina two to four cells long, the cells averaging 48 × 29 μ throughout. Underleaves less than half as wide as the leaves. Branch leaves and underleaves simliar to but smaller than those of the stem. Male and female inflorescences and sporophyte not seen. Fig. 2, a–d.

Habitat: On bark.

BRAZIL: s.l., *Ule 202*, (type G); Paraná, *Dusén 2946* (G); Apiahy, *Puiggari 257* (G); S. Catarina: Campo das Padre 2200 m, *Reitz 2557* (HBR).

The species has also been reported from Brazil by Herzog (1925a).

3. **Trichocolea elliottii** Stephani, Spec. Hep. **4**: 55. 1909.

Trichocolea opposita Stephani, Sv. Vet.-Akad. Handl. **46**^{9}: 77: 1911.
Trichocolea coalita Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 77. 1911

Plants large, in pale yellowish-green tufts; stems 6–7 cm long, with leaves 2 mm broad, pinnate, the branches 4–5 mm long; stems in transverse section 12–14 cells across, the cortical band of cells in one or two layers of smaller cells; stem paraphyllia absent. Rhizoids from the lamina of the branch underleaves and the male bracteoles, the tips expanded to form deeply lobed discs. Line of leaf insertion oblique, the leaves succubous. Leaves spreading, closely imbricate, asymmetric, to 1.3 mm long, 2 mm wide, divided to one-half of their length into five or six unequal, often branched segments; segments narrowly triangular, densely ciliate, the cilia simple or branched, the cells averaging 96 × 20 μ, the cuticle striolate-papillose; lamina to six cells high, the cells averaging 62 × 13 μ, sometimes appearing connate with the underleaves at the base. Underleaves half as wide as the leaves, symmetric, to 1 mm long, 1 mm wide, quadrifid (bisbifid), ciliate as in the leaves. Branch leaves and underleaves similar to but smaller than those of the stem. Plants dioicous. Male inflorescence intercalary on a lateral branch, the bracts and bracteoles in eight or more series, the bracts concave, to 1.2 mm long, 2 mm wide, divided to one-third of their length into five or six short, ciliate segments; antheridia large, globose, in pairs in the axils of the bracts, the stalk eight to ten cells long. Female inflorescence terminal on the stem or branch, with one or two subfloral innovations, the bracts and bracteoles in three series, the innermost series largest, the bracts to 2 mm long and wide, divided to one-half of their length into eight or ten unequal, often branched segments, ciliate as in the leaf, the cells of the lamina averaging 84 × 25 μ. Shoot/sporophyte relationship and sporophyte not seen. Fig. 3, a–e.

Habitat: On soil and the bark of trees.

CUBA: Oriente: crest of Sierra Maestra, *Morton & Br. Alain 9246, 9276, 9593, 9600* (US); Loma del Gato, *Br. León, Clement & Roco* (NY); s.l., *Br. León, 9902* (NY).

JAMAICA: Blue Mountain Peak, *Maxon & Killip 1180* (NY); Catherines Peak, *Baxter 50* (KANU); John Crow Peak, *Maxon & Killip 983* (NY), *M. Farr 962* (IJ); summit of High Peak, *M. Farr 906;* New Haven Gap, *van der Porten 159* (IJ), *Barry 495* (IJ), near Portland Gap, *M. Farr 615* (IJ), *Baxter 46* (KANU), *Maxon 9614a, 9627* (US); Sigoville, *van der Porten 111* (IJ); St. Thomas: summit Maccasucker Bump 825–1225 m, *Maxon 9533, 9611*, Stone Hole Bump, *Maxon* (NY).

PUERTO RICO: Mt. Britton, *Steere 4212*, (Hb. Fulford); La Torricella, *Steere 4050* (Hb. Fulford); La Crucita, *Steere 4776* (Hb. Fulford); Cerro de la Punta, *Steere 6207* (Hb. Fulford).

GUADELOUPE: s.l., *l'Herminier* (NY).

DOMINICA: s.l., *Elliott*, (type G); Morne Diablotin, *Elliott 1066* (BM).

MARTINIQUE: s.l., *Duss* (NY).

ST. VINCENT: s.l., *Smith 1445* (FH).

JUAN FERNANDEZ: s.l., *Skottsberg 135*, type of *T. opposita* (G); s.l., *Skottsberg 637*, type of *T. coalita* (G).

Additional records in the literature include, Jamaica (Pearson, 1931) Guadeloupe (Jovet-Ast, 1960) and Juan Fernandez (Arnell, 1957; Herzog, 1942a).

4. Trichocolea robusta Stephani, Spec. Hep.**4**: 58. 1909.

Plants large, in pale yellowish-green tufts; stems coarse, 5–8 cm long, with leaves to 3 mm wide, irregularly pinnate to bipinnate, the branches to 1 cm long; stems in transverse section to 15 cells across, the cortical band of one or two layers of smaller cells; stem paraphyllia scattered and in clusters, five to eight cells long, rarely branched, uniseriate. Line of leaf insertion oblique, the leaves succubous. Leaves distant to approximate, spreading, more or less symmetric, to 1.5 mm long, 2.8 mm wide, divided to one-half of their length into six to eight unequal, branched segments; segments with the divisions opposite or whorled, densely ciliate, the cilia simple or branched, the cells averaging 83 × 12 μ, the cuticle striolate-papillose; lamina to seven cells high, the cells averaging 80 × 36 μ. Underleaves smaller, symmetric, to 1.0 mm long, 1 mm wide, deeply bifid, the halves again divided, the four to six segments and cilia as in the leaves. Branch leaves and underleaves similar but smaller and with fewer segments than those of the stem. Male and female inflorescenses and sporophyte not seen. Fig. 4, a–d.

Habitat: On bark.

COLOMBIA: Prov. Antioquia: Páramo de Sonsón, *Jack,* (type G). There is a report of the species from Mexico (Davis [Pringle], 1936).

5. Trichocolea paraphyllina (Spruce) Stephani, Spec. Hep. **4**: 58. 1909.

Leiomitra paraphyllina Spruce, Trans. Proc. Bot. Soc. Edinb. 15: 350. 1885.
Trichocolea difficilis Stephani, Bibliot. Bot. 87: 230. 1916.

Plants large, in pale yellowish-green tufts; stems coarse, 6–8 cm long, with leaves to 2 mm wide, irregularly pinnate to bipinnate, the primary branches to 1 cm long; stems in transverse section 16–20 cells across, the cortical band of one or two layers of smaller cells; stem paraphyllia usually numerous except on the ventral side, five to eight cells long, rarely branched, uniseriate. Rhizoids in tufts from the lamina of the underleaf, the expanded tips often fused to form a disc-shaped plate. Line of leaf insertion oblique, the leaves succubous. Leaves distant to approximate, spreading, asymmetric, to 1.5 mm long, 2.5 mm wide, divided to one-half of their length into four to six unequal, often branched, segments; segments narrowly triangular, branched, sparingly ciliate, the cilia long, simple or branched, the cells long, the cuticle striolate-papillose; lamina six to eight cells high, the cells averaging 115 × 32 μ. Underleaves less than half as wide as the leaves, to 1.5 mm long, 1.0 mm wide, divided to three-fourths of their length into five or six unequal, often branched segments, the cilia similar to those of the leaf. Branch leaves and underleaves similar to those of the stem but smaller and with fewer segments. Male inflorescence not seen. Female inflorescence terminal on a stem or branch, with one or two subfloral innovations, the bracts and bracteoles in three series, symmetric, the bracts to 2 mm long, 2 mm wide, divided to two-thirds of their length into five to seven unequal

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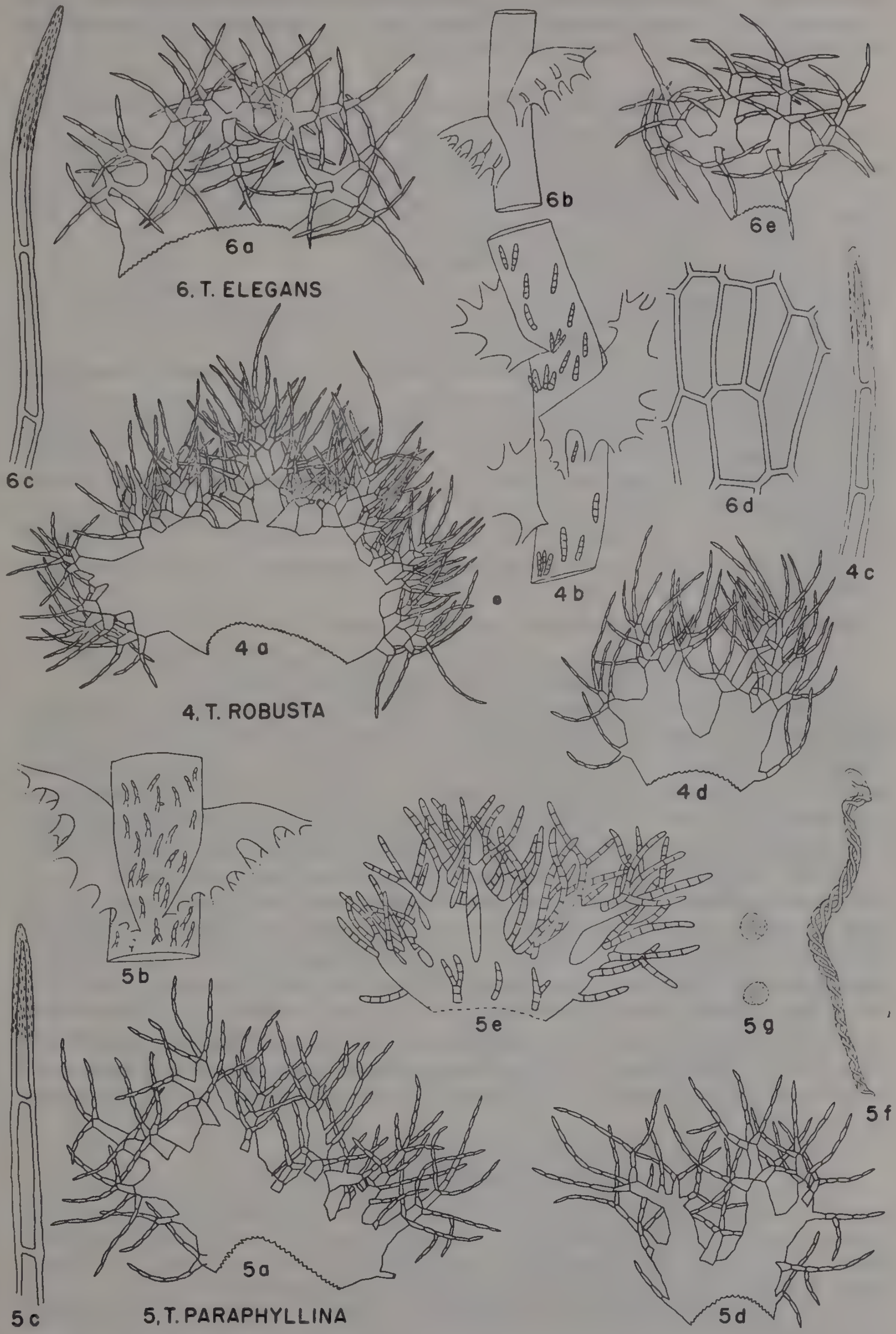
Fig. 4. *Trichocolea robusta.* 4 a. Stem leaf, × 55. 4 b. Stem showing leaf insertion and paraphyllia, dorsal view, × 12. 4 c. Portion of one of the cilia of a leaf, ×235. 4 d. Stem underleaf, × 55.

Fig. 5 *T. paraphyllina.* 5 a. Stem leaf, × 40. 5 b. Stem showing leaf insertion and paraphyllia, dorsal view, × 15. 5 c. Portion of one of the cilia of a leaf, × 235. 5 d. Underleaf, × 40. 5 e. Female bract, × 20. 5 f. Elater, × 235. 5 g. Spores, × 235.

Fig. 6. *T. elegans.* 6 a. Stem leaf, × 55. 6 b. Stem to show leaf insertion, × 10. 6 c. Portion of one of the cilia of a leaf, × 235. 6 d. Cells from the lamina of a leaf, × 235. 6 e. Underleaf, × 55.

Drawn from Hatcher, 1957.


6a
6b
6e
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6. T. ELEGANS

4. T. ROBUSTA

5. T. PARAPHYLLINA

often branched segments, ciliate as in the leaves. Shoot/sporophyte relationship a coelocaule. Coelocaule clubshaped, thick, fleshy, covered with paraphyllia, the unfertilized archegonia at the top. Fig. 5, a–g.

Habitat: On bark.

CUBA: Oriente: Sierra Maestra, *Morton 9552, 9554;* Oriente: along Río Peladero, *Morton 9495* (US); Oriente Loma El Gato, *Br. Hioram 136126* (F).

JAMAICA: Cuna Cuna Gap, *Maxon 9424;* John Crow Peak, *Britton* (NY), *Underwood 212* (NY); Morce's Gap, *Philipson 1193, 1221* (BM); w of Mossman's Peak, *Maxon 10211* p.p.; Sir John's Peak, *Philipson 1095* (BM); slopes above Tweedside, 900 m, *Maxon 1936;* Vinegar Hill Rd., *Johnson f 2* (F): s.l., *Eggers* (F); s.l., *Wills 2* (BM).

GUADELOUPE: s.l., *Duss* (NY).

DOMINICA: Morne Diablotin, *Elliott 1082* (BM).

MARTINIQUE: s.l., *Duss* (NY).

MEXICO: Pueblo: near Honey Station, *Pringle 15332* (as *T. robusta*) (FH).

GUATEMALA: Quezaltenango: Quebrada El Pocito, *Standley 85063* (F).

COSTA RICA: s.l., *Brenes 20504* (F).

COLOMBIA: s.l., *Weir* (NY); Antioquia, *Bischler 65* (COL); Cauca: Páramo de Las Papas, *Bischler 727, 934* (COL).

VENEZUELA: Estado Bolívar, Chimantá Massif, Abacapá-tepuí, *Steyermark 75025* p.p. (NY); Mt. Roraima, *Steyermark 58708* p.p. (F): Cerro der la Neblina, Río Yatua, *Maguire, Wurdack & Maguire 42550* (NY).

ECUADOR: Mt. Tungurahua, *Spruce* (NY); Mt. Guayrapata, *Spruce,* (isotype NY); s.l., *Fraser 11* (BM); Pichincha, *Jameson 258* (BM).

BOLIVIA: s.l., *Herzog, 4331,* type of *T. difficilis* (G); Incachaca, *Brooke 6725A, 6811* p.p. (BM).

The additional reports in the literature include, Guadeloupe (Jovet-Ast, 1960) and Ecuador (Spruce, 1885).

6. **Trichocolea elegans** Lehmann, Pug. **10**: 8. 1875.

Trichocolea verticillata Stephani, Bihang Sv. Vet.-akad. Handl. III. $\mathbf{26^6}$: 57. 1900.
Trichocolea decrescens Stephani, Sv. Vet.-akad. Handl. $\mathbf{46^9}$: 77. 1911.

Plants of medium to large size, pale yellowish-green, in tufts or scattered among other bryophytes; stems to 5 cm long, with leaves to 2 mm wide, pinnately or bipinnately branched, the branches mostly 4 or 5 mm long; stems in transverse section to 16 cells across, the cortical band of one or two layers of somewhat smaller cells. Line of leaf insertion oblique, with the leaves succubous. Leaves distant to approximate, spreading, subsymmetric, rarely long-decurrent, to 1.0 mm long, 1.5 mm wide, divided to one-half of their length into usually five major segments; the segments bifid or trifid with one of the divisions bent back at a right angle to the lamina, the divisions sparingly ciliate, the cilia long, simple or rarely branched, recurved, the cells averaging $95 \times 9\ \mu$, the cuticle striolate-papillose; lamina six to eight cells high, the cells averaging $64 \times 25\ \mu$. Underleaves smaller, to 0.8 mm long, 1 mm wide, divided to one-half of their length into two groups of three segments each with one of the segments of each group bent backward as in the leaf, the cilia as in the leaf. Branch leaves and underleaves similar, smaller. Male and female inflorescences and sporophyte not seen. Fig. 6, a–e.

Habitat: On soil or over other bryophytes.

BRAZIL: S. Paulo: Campo Grande, *Schiffner 463* p.p. 479 c (W).

PATAGONIA-TIERRA DEL FUEGO: s.l., *Middleton* (BM); Corral, *Thaxter 117* p.p. (MICH); Desolation I: Puerto Angosta, *Dusén 391* (G); Valdivia, *Lechler,* (type NY), *Hahn* (G); s.l., *Dusén,* type of *T. verticillata* (G); Corral, *Kräuse* (G), *Thaxter 117* p.p. (MICH), *Thaxter 32, 132* (NY); Pto. Varas, *Gertrud & Hosseus 297* (NY); s.l., *Dusén* (NY); Puerto Bueno, *Dusén 52* (G); Cal. Rayo, *Skottsberg 587,* type of *T. decrescens* (G).

JUAN FERNANDEZ: Masatierra, *Skottsberg 137* (as *T. decrescens*) (G), *Skottsberg 375, 384, 385, 386* (NY).

Additional reports, in the literature, include, Chile (Arnell, 1955; Herzog, 1923, 1940, 1954; Herzog & Schwabe, 1939; Müller, 1955: Reimers, 1926; Stephani, 1900 a, b, 1901a, 1911), Argentina (Kühnemann, 1949), Tierra del Fuego (Gola, 1923) and Juan Fernandez (Arnell, 1957; Herzog, 1942a).

The species is also reported from Tristan da Cunha (Arnell, 1958) and Australia (Stephani, Spec. Hep., 1909).

7. **Trichocolea brevifissa** Stephani, Spec. Hep. **4**: 54. 1909.

Trichocolea subquadrata Stephani, Spec. Hep. 4: 53. 1909.
Trichocolea cubensis Stephani, Spec. Hep. 4: 54. 1909.

Plants of medium size, in pale yellowish-green tufts; stems 3–4 cm long, with leaves to 2 mm wide, pinnate to bipinnate, the branches mostly 3–4 mm long; stems in transverse section to 16 cell across, the cortial band of one to two layers of smaller cells; stem paraphyllia absent. Rhizoids not seen. Line of leaf insertion oblique, the leaves succubous. Leaves distant to approximate, spreading, to 1 mm long, with leaves to 1.5 mm wide, divided to one-fourth or one-third of their length into four or five short, branched segments; segments usually bifid, the cilia short, simple or rarely branched, single and in pairs or whorled, the cells averaging 83 × 16 μ, the cuticle striolate-papillose; the lamina eight to fourteen cells high, asymmetric, the cells averaging 58 × 26 μ. Underleaves smaller, to 0.7 mm long, 1 mm wide, divided to one-half of their length into usually four branched segments, the cilia as in the leaf, a rhizoid disc without rhizoids often developed on the lamina. Branch leaves and underleaves similar to those of the stem, smaller. Male inflorescence intercalary or terminal on a stem or branch, the bracts and bracteoles in five or more series, the bracts concave, to 0.8 mm long, 1.3 mm wide; antheridia large, globose, solitary, the stalk 14–16 cells long. Female inflorescence and sporophyte not seen. Fig. 7, a–d.

Habitat: On bark of trees and on leaves.

CUBA: s.l., *Wright*, type of *T. cubensis* (G); *Yuncker 12590* (DBU).

JAMAICA: Abbey Green, *Orcutt 5284* (US, BM); near Cuna Cuna Gap, *Maxon 8988* (US); Hardwar Gap, *Baxter 24* (KANU); Morce's Gap, *Philipson 1219* (BM); Mossman's Peak, *M. Farr 734* Sir John Peak, *Philipson 1088b* (BM); summit of Morne Quimby, *Proctor 1481* (IJ).

DOMINICAN REPUBLIC: La Vega: Loma Campana, *Allard 18636* (BM).

PUERTO RICO: s.l., *Sintenis 84* (as *T. subquadrata*) (G); Mt. Torricella, *Britton, Cowell & Brown* (NY); near Las Picachos, *Pagán 322* (FH).

DOMINICA: Morne Diablotin, *Elliott 1009, 1061a, 1071c* p.p., *2190, 2218* (BM).

MARTINIQUE: s.l., *Perrotet 36* (as *T. subquadrata*) (G).

TRINIDAD: s.l., *Crüger* (as *T. subquadrata*) (G, FH); Mt. Tucuche, *Britton, Coker, Rowland 1475, 1483* (NY).

BRAZIL: s.l., *Ule,* (type G); S. Catarina: Campo dos Padres, 2000 m, *Reitz 2.545, 2.565.* S. Paulo: Campo Grande, *Schiffner 461* (W).

Additional reports of the species, in the literature, include, Cuba (Welch, 1950), Jamaica (Pearson, 1931), Gaudeloupe (Jovet-Ast, 1960) and Brazil (Stephani, 1903a).

8. **Trichocolea flaccida** (Spruce) Jack & Stephani, Hedwigia **31**: 14. 1892.

Leiomitra flaccida Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 349. 1885.
Trichocolea tomentosa var. *canelensis* Spruce ms *Hepat. Spruc.*
Trichocolea patula Stephani, Spec. Hep. **4**: 57. 1909.
Trichocolea inaequalis Stephani, Spec. Hep. **4**: 59. 1909.
Trichocolea eggersiana Stephani, Spec. Hep. **4**: 59. 1909.
Trichocolea herzogii Stephani, Biblioth. Bot. **87**: 230. 1916.

Plants of medium size, in pale yellow-green tufts; stems slender, 4–8 cm long, with leaves to 1 mm wide, irregularly pinnate to bipinnate, the branches mostly 5 mm long; stems in transverse section 8–12 cells across, the cortex of a unistratose layer of somewhat smaller cells; stem paraphyllia absent. Rhizoids in tufts from rhizoid pads on the lamina of the underleaves, long, the tips expanded to disc-shaped plates. Line of leaf-insertion oblique, the leaves succubous. Leaves distant to imbricate, spreading, asymmetric, to 1.5 mm long, 1 mm wide, divided to one-half or more of their length into four or five unequal branched segments; the segments narrowly triangular, the two or three branches of each segment opposite or whorled, the cilia long, few, simple or rarely branched, the cells long, the cuticle striolate-papillose; lamina four or five cells high, the cells averaging 62 × 19 µ. Underleaves 1.0 mm long, 0.3 wide, divided to one-fourth of their length into four (bisbifid) segments each with one to three cilia as in the leaf. Branch leaves and underleaves similar to those of the stem, smaller. Male inflorescence intercalary on a stem or branch, the bracts and bracteoles in ten or more series, the bracts concave, divided into five or six segments; antheridia, large, globose, the stalk 12–14 cells long. Female inflorescences and sporophyte not seen. Fig. 8, a–d.

CUBA: Sierra di Gavilanes, *León & Luna 6721* (NY).

JAMAICA: Hardwar Gap to Waterfall, *Bengry 380* (IJ).

DOMINICAN REPUBLIC: Loma Campana, *Allard 18572* p.p. (BM).

ST. KITTS: s.l., *Breutel* (BM).

GUADELOUPE: s.l., *l'Herminier* (NY).

DOMINICA: s.l., *Eggers*, type of *T. patula* (G); s.l., *Elliott*, type of *T. eggersiana* (G): Morne Cousonne, *Elliott 201a, 210a* p.p., *214b* (BM).

MARTINIQUE: s.l., *Stehlé 3627*.

MEXICO: Puebla: El Cerro de Cahuatepec, *Sharp, 1397* (TENN); Puebla Huachingango, *Sharp 3212* (TENN); Zacapoaxtla, *Sharp 4239* (TENN); Vera Cruz, below Altotonga, *Sharp 5596* (TENN); Sierra between Río Grande & Oaxaca, *Sharp 5702* (TENN).

GUATEMALA: El Progreso, Finca Bucaral, *Sharp 2734* (TENN); Baja Verapaz, Finea Bucaral, *Sharp 2765* (TENN); above Nebaj, *Sharp 2511a* (TENN); s.l. or collector, type of *T. inaequalis* (G).

COLOMBIA: Bogotá, *Weir* (NY); Huila-Cauca: Páramo de las Papas, *Bischler 690* (COL).

VENEZUELA: Bolívar: Mt. Roraima, *Steyermark 58969a, 58969c* (F). Bolívar: Ptarí-tepuí, *Steyermark 59816b* (F); Sucre: Cerro Turumiquire, *Steyermark 6264* p.p. (F).

ECUADOR: Canelos, *Spruce* (isotype NY), *Spruce, Hepat. Spruc.* [as *T.* (*Leiomitra*) *tomentosa* var. *canelensis* p.p.] (NY); s.l., *Fraser 13* (BM); s.l., *Jameson 153* p.p. (BM).

PERU: Mt. Campana, *Spruce, Hepat. Spruc.* (NY).

BOLIVIA: s.l., *Herzog 4297*, type of *T. herzogii* (Hb. Herzog).

There are additional reports of the species in the following literature, Puerto Rico (Stephani, 1888;; Pagán, 1939), Guadeloupe (Bescherelle, 1893; Pagán, 1942; Jovet-Ast, 1960), Dominica (Spruce, 1895), Costa Rica (Herzog, 1938a), Brazil (Spruce, 1888a), Peru (Jack & Stephani, 1892) and Bolivia (Herzog, 1916).

9. **Trichocolea argentea** Herzog, Arq. Bot. S. Paulo **1**: 40. *f. 2.* 1925.

Plants small, in pale yellowish-green tufts or scattered among mosses; stems 2–3 cm long, with leaves to 0.7 mm wide, regularly pinnate, the branches mostly 3–4 mm long; stems in transverse section to 9 cells across, the unistratose cortex

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FIG. 7. *Trichocolea brevifissa.* 7 a. Stem leaf, × 55. 7 b. Stem showing leaf insertion, dorsal view, × 10. 7 c. Portion of one of the cilia of a leaf, × 235. 7 d. Stem underleaf, × 55.

FIG. 8. *T. flaccida.* 8 a. Stem leaf, × 55. 8 b. Portion of a stem to show leaf insertion, dorsal view, × 25. 8 c. Portion of one of the cilia of a leaf, × 235. 8 d. Stem underleaf, × 55.

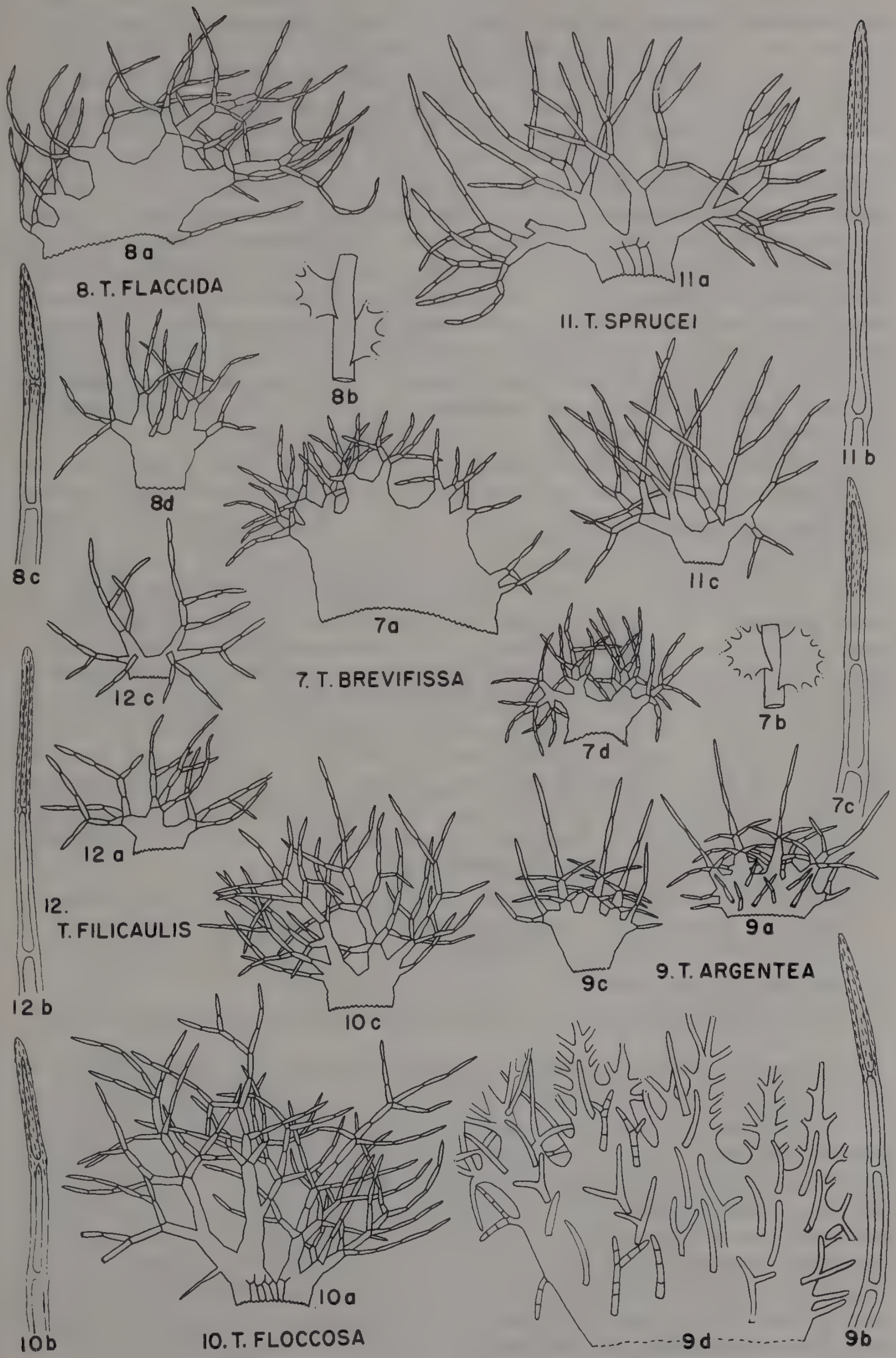
FIG. 9. *T. argentea.* 9 a. Stem leaf, × 55. 9 b. Portion of one of the cilia of the leaf, × 235. 9 c. Underleaf, × 55. 9 d. Female bract of the inner series, × 55.

FIG. 10. *T. floccosa.* 10 a. Stem leaf, × 55. 10 b. Portion of one of the cilia of a leaf, × 235. 10 c. Stem underleaf, × 55.

FIG. 11. *T. sprucei.* 11 a. Stem leaf, × 55. 11 b. Portion of one of the cilia of a leaf, × 235. 11 c. Stem underleaf, × 55.

FIG. 12. *T. filicaulis.* 12 a. Stem leaf, × 55. 12 b. Portion of one of the cilia of a leaf, × 235. 12 c. Stem underleaf, × 55.

Drawn after Hatcher, 1957.


8a
8. T. FLACCIDA
8b
8c
8d
11a
11. T. SPRUCEI
11b
11c
7a
7. T. BREVIFISSA
7b
7c
7d
12c
12a
12.
T. FILICAULIS
12b
10c
9a
9c
9. T. ARGENTEA
9d
9b
10a
10b
10. T. FLOCCOSA

of somewhat smaller cells; stem paraphytia absent. Rhizoids not seen. Line of leaf insertion oblique, the leaves succubous. Leaves imbricate, subsymmetric, to 0.6 mm long, to 0.5 mm wide, divided to one-half of their length into four or five segments; segments narrowly triangular, sparsely ciliate with paired cilia, the cells averaging 100 × 10 μ, the cuticle striolate-papillose; lamina four or five cells high, bearing scattered superficial cilia, its cells averaging 38 × 25 μ. Underleaves to 0.4 mm long, 0.3 mm wide, divided to one-half of their length into four or five ciliate segments as in the leaf. Branch leaves and underleaves similar to those of the stem, smaller, without superficial cilia on the lamina. Plants dioicous. Male inflorescence intercalary, near the tip of the stem or branch, the bracts and bracteoles in nine or more series, similar to the leaves and underleaves but larger; antheridia large, globose, occurring singly. Female inflorescence terminal on the stem or a branch, the bracts and bracteoles in three series, the bracts to 1.3 mm long, 1 mm wide, divided to one-half of their length into five or six often branched segments, ciliate as in the leaves; lamina of the bracts and bracteoles eight or nine cells high with numerous superficial cilia. Shoot/sporophyte relationship and sporophyte not seen. Fig. 9, a–d.

Habitat: In mats on the soil or among other bryophytes.

BRAZIL: S. Paulo, Estação Biológico do Alto da Serra, *Herzog 7769*, (type Hb. Herzog).

10. **Trichocolea floccosa** Herzog & Hatcher, Lloydia **20**: 148–150. *f. 5–7.* 1957.

Plants small, pale yellowish-green, in tufts; stems slender, 3–5 cm long, with leaves to 1.2 mm broad, pinnate to irregularly bipinnate, the branches 5–8 mm long; stems in transverse section 8–10 cells across, the unistratose cortex of smaller cells; stem paraphyllia absent. Rhizoids not seen. Line of leaf insertion oblique, the leaves succubous. Leaves approximate, spreading, subsymmetric, to 1.0 mm long, 1.0 mm wide, bisbifid nearly to the base; segments narrowly triangular, branched, the cilia long, opposite or whorled, the cells averaging 110 × 10 μ, the cuticle striolate-papillose; lamina one to a few cells high, the cells averaging 55 × 18 μ. Underleaves smaller, to 1 mm long, 0.7 mm wide, quadrifid to bisbifid to three-fourths of their length, the cilia as in the leaf. Branch leaves and underleaves similar to those of the stem, smaller. Male and female inflorescences and sporophyte not seen. Fig. 10, a–c.

Habitat: Not given.

COSTA RICA: Santa Clara, *Maxon 8194*, (type Hb. Herzog).
Additional report, Guadeloupe (Jovet-Ast, 1960).

11. **Trichocolea sprucei** Stephani, Spec. Hep. **4**: 59. 1909.

Trichocolea gracillima Spruce, Jour. Linn. Soc. Bot. 30: 353. 1895. Non *T. gracillima* Austin.

Plants small, pale yellowish-green, in tufts; stems slender, to 5 cm long, with leaves to 1.2 mm broad, pinnate, the branches to 7 mm long; stems in transverse section 8–10 cells across, the unistratose cortex of slightly smaller cells; stem paraphyllia absent. Rhizoids not seen. Line of leaf insertion oblique, the leaves succubous. Leaves approximate, spreading, subsymmetric, to 1 mm long, 1.3 mm wide, quadrifid (bisbifid) to five-sixths of their length, the four segments, branched, nearly equal, triangular, ciliate with long simple or branched cilia, the cells averaging 120 × 10 μ, the cuticle striolate-papillose; lamina one to a few cells high, the cells averaging 91 × 29 μ. Underleaves smaller, to 0.8 mm long, 0.8 mm wide, quadrifid to near the base, ciliate as in the leaves. Branch leaves and underleaves similar, smaller. Male and female inflorescences and sporophyte not seen. Fig. 11, a–c.

Habitat: On tree trunks.

GUADELOUPE: Forêt de Baines Jaunes, *LeGallo 260* (Hb LeGallo).
DOMINICA: Mt. Diablotin, *Elliott 684*, (type Manch).
TRINIDAD: Asinia—Blanchissense Rd, Morne Bleu, *A. C. Smith* (US).

12. Trichocolea filicaulis Stephani, Spec. Hep. **4**: 59. 1909.

Trichocolea paupercula Stephani, Bibliot. Bot. 87: 230. 1916.

Plants filiform, pale yellowish-green, in tufts or among other bryophytes; stems very slender, 2–3 cm long, with leaves to 1.0 mm broad, simple to irregularly pinnate, the branches mostly 2–3 cm long; stems in transverse section to five cells across, the unistratose cortical cells scarcely smaller than the cells of the medulla; stem paraphyllia absent. Rhizoids not seen. Line of leaf insertion oblique, the leaves succubous. Leaves distant to approximate, spreading, asymmetric, to 0.5 mm long, 0.8 mm wide, divided to three-fourths of their length into three segments; segments unequal, rarely branched, the few cilia long, simple or branched, the cells long, the cuticle striolate-papillose; lamina one or two cells high, the cells averaging 63 × 22 μ. Underleaves mostly as large as the leaves, deeply bifid or bisbifid, the cilia similar to those of the leaf. Branch leaves and underleaves similar to those of the stem. Male and female inflorescences and sporophyte not seen. Fig. 12, a–c.

Habitat: On bark.

DOMINICAN REPUBLIC: s.l., *Elliott* (G).
GUADELOUPE: s.l., *l'Herminier* (type G).
DOMINICA: Cauliabon, *Elliott 1894a;* Morne Diablotin, *Elliott 2161.* (BM).
GUATEMALA: Nebja, *Sharp 2514.*
BOLIVIA: Cormarapa, *Herzog 4314*, type of *T. paupercula* (G).

Additional records reported Dominica (Pagán, 1942), Guadeloupe (Jovet-Ast, 1960), Bolivia (Herzog, 1916).

Taxon not seen.

Trichocolea tomentosa var *platyclada* Spruce, Jour. Linn. Soc. Bot. **30**: 353. 1895. Dominica.

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Hatcher, R. 1957. The genus *Trichocolea* in North, Central and South America (Hepaticae). Lloydia **20**: 139–185. *f. 1–184.*

———. 1959. The structure of the female inflorescence and its taxonomic value in the genus *Trichocolea* (Hepaticae). Lloydia **22**: 208–214. *f. 1–6.*

Temnoma Mitten in W. J. Hooker, Handb. N. Zeal. Flora 750. 1867.

Jungermannia auctt. p.p.
Jungermannia sect. I. *Temnoma* (Mitten) Bescherelle & Massalongo, Miss. Sci. Cap Horn. Bot. 5: 214. 1889.

Plants of small to medium or large size, whitish becoming light brown, or greenish-brown to dark brown, erect or ascending, radially symmetric, in tufts or cushions or among other bryophytes; stems simple or with an occasional branch, the branches lateral, of the *Frullania* type, with the half-leaf at the dorsal base of the branch; stem in transverse section with the cortical cells scarcely smaller than those of the medulla. Rhizoids when present in tufts from the lamina of the underleaves, the tips branched. Line of leaf insertion transverse or oblique, the leaves succubous. Leaves quadrate-orbicular to quadrate or rectangular, symmetric, quadrifid to one-half or four-fifths of their length, in some species with an additional large tooth or shorter segment on either side of the base of the lamina; margins with very numerous, long, spreading cilia, or the cilia shorter, two to four cells long, in a few opposite pairs on the segments and a few on the margins of the lamina, or entire; cuticle striolate. Underleaves like the leaves or slightly smaller. Plants dioicous. Male inflorescence terminal but becoming intercalary on the stem or branch, the bracts and bracteoles in four to ten series, a little larger than the leaves and underleaves, with more cilia; antheridia large, one or two in the axils of the bracts. Female inflorescence terminal on the stem or a long branch, without or with one or two subfloral innovations, the bracts and bracteoles similar and like the leaves and underleaves, with more cilia on the margins (in species with few or no cilia on the leaves, the margins of the bracts and bracteoles with numerous short cilia, the segments always with numerous pairs), the inner series the largest; archegonia ten to fifteen, flask-shaped with a narrow neck. Perianth long, cylindric, with three rounded keels above, without superficial paraphyllia, the mouth scarcely contracted, spinose to long-ciliate. Sporophyte seta in transverse section of a large number of cells, the outer layer of 18–20 large cells surrounding the numerous similar or smaller cells of the of the medulla; capsule ovoid-cylindric, reddish-brown, the wall of four to six layers of cells, the outermost layer of very large, hyaline cells, the inner layers of smaller cells with the characteristic brown, rod- or band-shaped thickenings; elaters reddish-brown, with two or three spirals, the ends blunt-tapering; spores reddish-brown.

Type species: *Jungermannia pulchella* W. J. Hooker, Musci Exot. *pl. 94.* 1818. New Zealand.

Key to the Species

1. Leaves and underleaves appearing to be almost completely made up of long, intricately interwoven cilia, the cilia occurring singly, or in opposite pairs along the margins of the segments and on the margin of the lamina.

  2. Cells of the cilia mostly 40–54 (72) μ long, the tip cells mostly 36 μ long. 1. *T. pilosum.*

  2. Cells of the cilia mostly more than 72 μ, the tip cells 54–72 μ, mostly 72 μ long. 2. *T. chilense.*

1. Leaves and underleaves with much of the lamina evident, divided to one-half or more of their length; margins of the segment entire or with a few single or opposite pairs of short, spinose cilia; perianth 3-keeled above, the mouth broad, spinose to ciliate.

  2. Leaves quadrifid, the margins without teeth, the segments uniseriate from a 2-celled base, the cuticle very coarsely striate. 5. *T. pungens.*

  2. Leaves quadrifid, with a conspicuous accessory, narrowly triangular, spreading to decurved, long tooth at the base on both sides of the lamina.

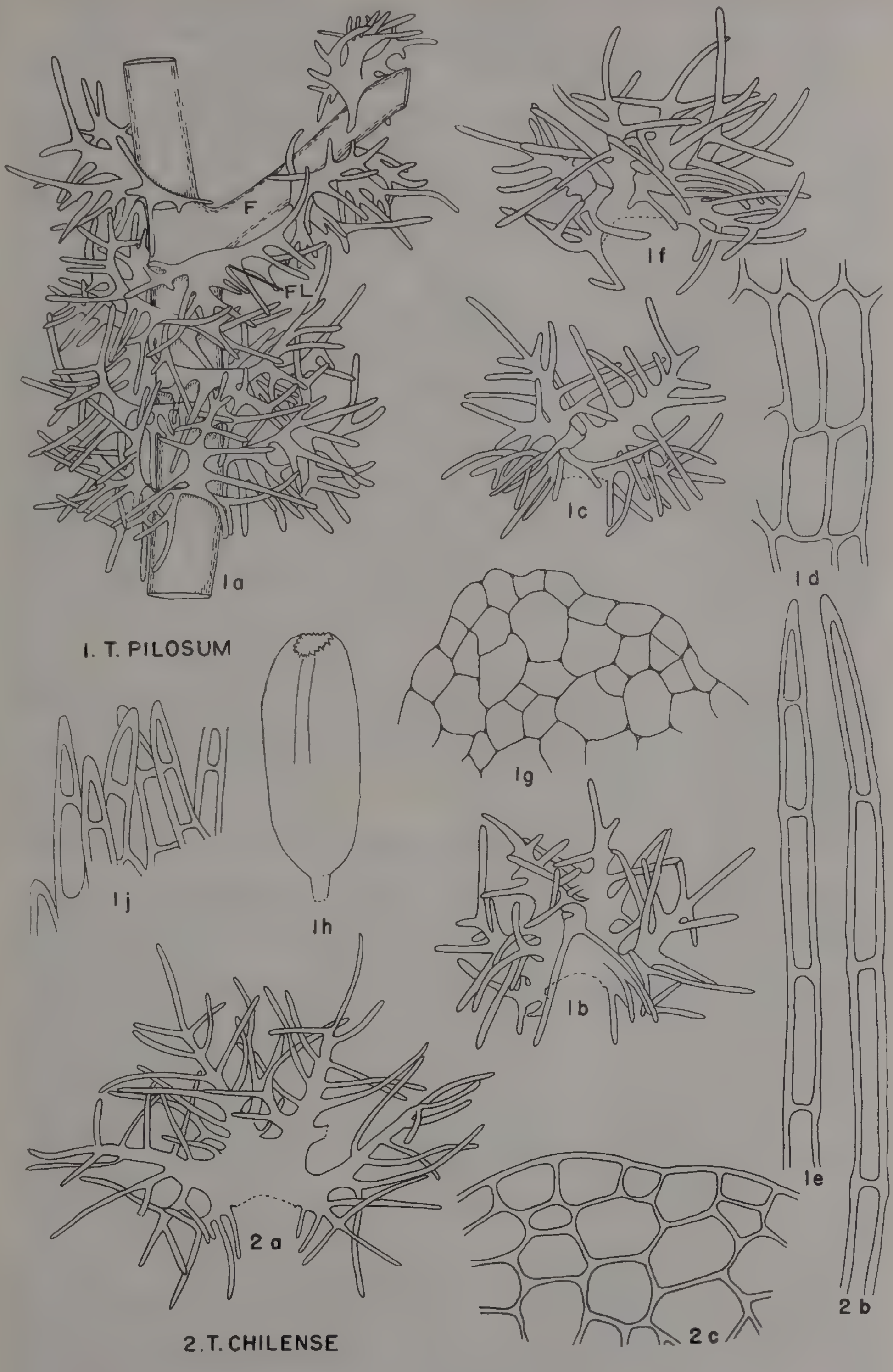
    3. Segments mostly two to four cells broad at the base, to twelve cells long, the margins with one to three opposite pairs of spinose cilia; superficial spines of one to three cells on the ventral side of the lamina; perianth mouth short-spinose. 3. *T. quadripartitum.*

    3. Segments to six cells broad at the base, to 20 cells long, the margins entire or with occasional long cilia or teeth; lamina with several long teeth or cilia on both sides. 4. *T. subintegrum.*

FIG. 1. *Temnoma pilosum.* 1 a. Stem, dorsal view, × 32; F, branch of the *Frullania* type; FL, half-leaf with this branch. 1 b. Leaf, × 32. 1 c. Half-leaf associated with the *Frullania* type branch, × 32. 1 d. Cells of the lamina, × 290. 1 e. Portion of one of the cilia of a leaf, × 350. 1 f. Underleaf, × 32. 1 g. Portion of a transverse section of a stem, × 350. 1 h. Perianth, × 15. 1 j. Portion of the mouth of the perianth, × 350.

FIG. 2. *T. chilense.* 2 a. Leaf, × 33. 2 b. Portion of one of the cilia of a leaf, × 350. 2 c. Portion of a transverse section of a stem, × 350.

FIGS. 1 a–f after Evans, 1898.


F
FL
1f
1c
1d
1a
1g
1h
1j
1b
1e
2a
2b
2c

1. T. PILOSUM

2. T. CHILENSE

1. **Temnoma pilosum** (Evans) Schuster, Bryologist **62**: 240. 1959 (1960).
Blepharostoma pilosum Evans, Bull. Torrey Club **25**: 418. *pl. 345.* 1898.
Blepharostoma pinnatisetum Stephani, Spec. Hep. **3**: 639. 1909.
Temnoma pinnatisetum (Stephani) Schuster, Bryologist **62**: 240. 1959.

Plants julaceous, appearing to be composed of long, intricately interwoven capillaceous cilia, erect, tending to be radially symmetric, brownish-green, in deep tufts or cushions; stems slender, 2–4 cm long, with leaves to 0.2 mm wide, sparingly pinnate, the branches lateral, of the *Frullania* type, the half-leaf with only two major segments, at the dorsal base of the branch; stem in transverse section with the cells of the unistratose cortical layer scarcely smaller than those of the medulla. Rhizoids scarce, from the lamina of the underleaves. Line of leaf insertion transverse. Leaves widely spreading, tending to be decurved in the outer part, broadly orbicular-quadrate in outline, to 0.85 mm long and wide, quadrifid to four-fifths of their length, or six-parted through the development of a large basal tooth on the outer segment on either side; segments four to seven cells wide at the base, lanceolate, with five to eight pairs of opposite, long, divaricate cilia, tapering to a uniseriate tip of five to eight cells, the cells 40–54 (72) × 18 μ, the tip cell shorter; lamina mostly four cells high, the cells mostly 36–42 × 16 μ, the cuticle faintly striolate. Underleaves like the leaves. Female inflorescence terminal on the stem, without innovations, the bracts and bracteoles in a few series, like the leaves, the inner series larger. Perianth long, cylindric, with three rounded keels above, the mouth broad, spinose to short-ciliate. Male inflorescence and sporophyte not seen. Fig. 1, a–j.

Habitat: On wet sandy soil.

PATAGONIA—TIERRA DEL FUEGO: Villarina Bay, J. B. Hatcher (type Y; isotype NY); Río Aysen, *Dusén 515*, type of *B. pinnatisetum* (G), *Dusén 312* (♀) (G-1795, NY), *Dusén 290* (G-1792); s.l., *Nordenskjöld* (G); Chiloe, *Halle* (G-1793).

There are additional reports of the species in this area by Arnell (1955), Stephani (1911), and Herzog & Schwabe (1939).

2. **Temnoma chilense** Fulford, sp. nov.

Similis *T. piloso* sed cellulis laminae ciliisque longioribus; laminae cellulis 40–54 μ, ciliis plus quam 72 μ.

Plants julaceous, large, appearing to be composed of long, capillaceous cilia, ascending to erect, tending to be radially symmetric, brownish-green, in deep tufts or cushions; stems 4–6 cm long, the leaves 2–2.5 mm wide, sparingly pinnate; stems in transverse section with cells of the unistratose cortical layer scarcely smaller than those of the medulla. Line of leaf insertion transverse. Leaves widely spreading, at a right angle to the stem, the outer part tending to be decurved, broadly orbicular, 1 mm long, 2 mm wide, quadrifid to four-fifths or more and with a shorter segment on either side of the base; segments lanceolate, branched and ciliate with opposite pairs, the cilia spreading, five to eight or more cells long, the cells mostly more than 72 μ long, the tip cell 54–72 μ; cell of the lamina mostly 40–54 × 22 μ, thin-walled, the cuticle striolate. Underleaves like the leaves. Male and female inflorescences and sporophyte not seen. Fig. 2, a–c.

Habitat: On moist shaded sandy bank near a spring.

PATAGONIA—TIERRA DEL FUEGO: Puerto Varis, *R. Hatcher & Fulford* (type Hb. Fulford, isotype Hb. Hatcher).

The species is very similar to *T. pilosum* except for the larger size, and the longer cells of the lamina and the cilia of the leaves and underleaves.

3. Temnoma [Teinnoma] quadripartitum [-a] (W. J. Hooker) Mitten in J. D. Hooker, Philos. Trans. Roy. Soc. **168** (extra vol.): 33. 1879.

Jungermannia quadripartita W. J. Hooker, Musci Exot. **2:** *pl. 117.* 1820.

Jungermannia podophylla Ångström, Öfvers. Vet.-akad. Forhandl. 29^{4}: 11. 1872. Non *J. podophylla* Thunberg.

Blepharostoma quadripartita (W. J. Hooker) Trevisan, Mem. Ist. Lomb. III. **4:** 417. *pl. 345, f. 7, 8.* 1877.

Plants very small, brownish, reddish-brown or black, in tufts or scattered among other bryophytes; stems filiform, erect, radially symmetric, 1–2 cm long, sparingly branched, the branches lateral, the half-leaf with two major segments, at the dorsal base of the branch. Rhizoids in fascicles from the lamina of the underleaves, the tips much branched. Line of leaf insertion transverse. Leaves small, distant, subquadrate, 0.48 mm long, 0.45 mm wide, quadrifid (rarely trifid) to three-fourths of their length, with a conspicuous, spreading, decurved tooth from the basal margin of the lamina on both sides; segments two to four cells broad at the base, to twelve cells long, the margins with short, spine-like cilia one to three cells long, singly or in one to three opposite pairs; lamina with a few marginal cilia and the pair of longer basal teeth, and with 1–3-toothed superficial spines scattered on the ventral surface below the segments; leaf-cells 27–36 μ × 20–27 μ, the walls thin, the trigones inconspicuous, the cuticle striolate. Underleaves like the leaves. Plants dioicous. Male inflorescence terminal on the stem or branch, soon becoming intercalary in position, the bracts and bracteoles in four to six series, the bracts concave, slightly larger than the leaves, with a larger lamina and shorter segments with more spines and cilia than the leaves, without the conspicuous basal pair; antheridia one or two in the axils of the bracts. Female inflorescence terminal on the stem, with one or two subfloral innovations, the bracts and bracteoles larger than the leaves and underleaves, of similar pattern but with six to eight pairs of cilia on the segments and more cilia on the margins of the lamina, the basal pair of teeth also ciliate. Perianth long, cylindric with three rounded keels above, the mouth broad, truncate, short-spinose. Fig. 3, a–g.

Habitat: On soil and humus in moist areas.

PATAGONIA—TIERRA DEL FUEGO: Magellan Straits: Port Famine, *Andersson* (♀), (NY, G); Halt Bay, *Cunningham*, ex Hb. Kew (G); s.l., *Halle* (G); Hermite I., *Hariot* (♀), ex Hb. Bescherelle (G); Staten I., prope Cap Horn, *Menzies* (type K); Río Aysen, *Dusén* (G-1796).

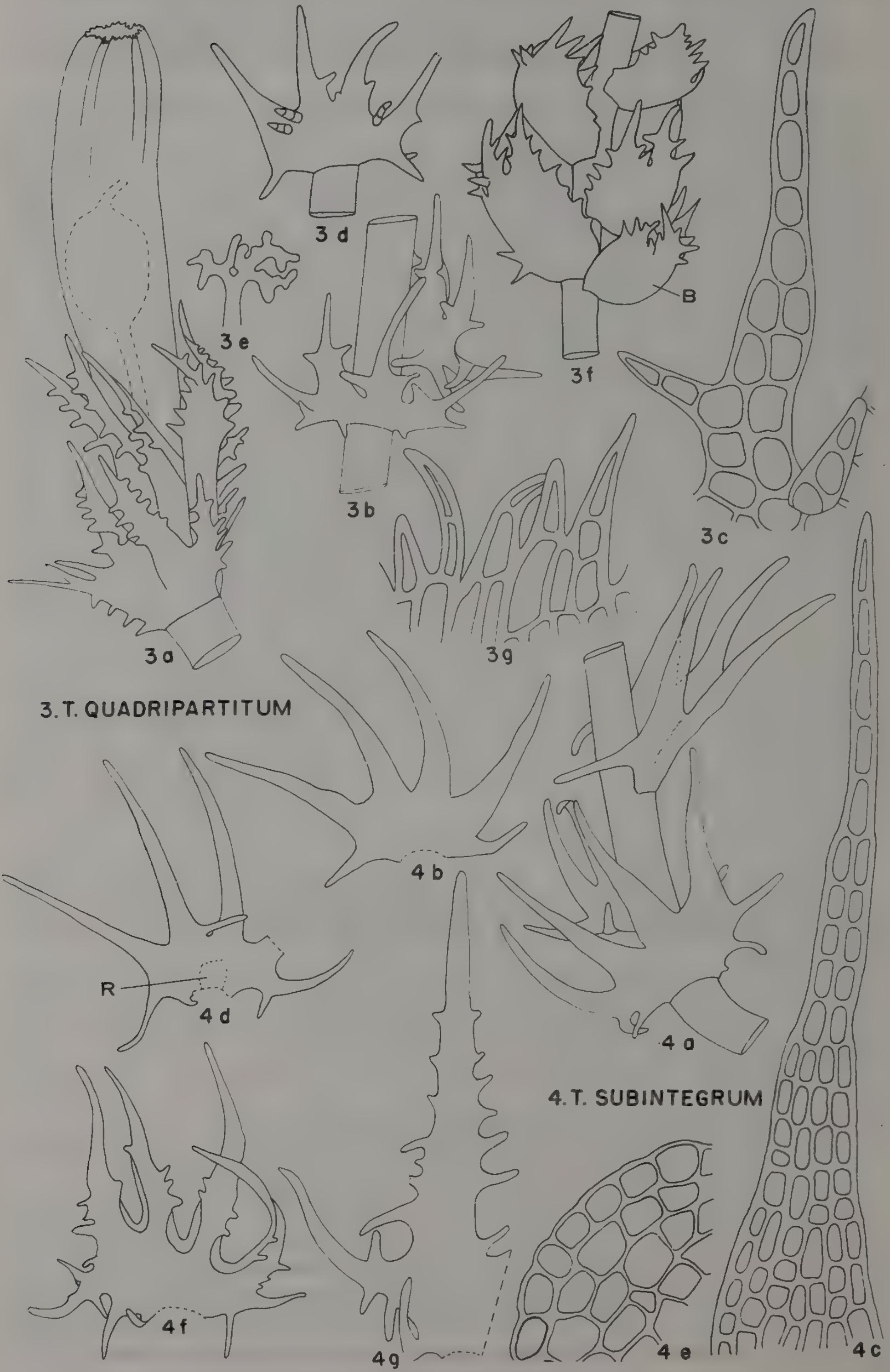
There are many reports of the species in the literature, including: from this same area, those of Ångström (1872), Arnell (1955), Bescherelle & Massalongo (1889), Evans (1898), Gola (1923), Herzog (1954, 1957), Kühnemann (1949), Massalongo (1885, 1908, 1927b), and Stephani (1900 a, b, 1911).

The species has also been found on Tristan da Cunha (Arnell, 1958) and Kerguelen Islands (Mitten, 1877, 1884).

4. Temnoma subintegrum (Stephani ms.) Fulford, sp. nov.

Blepharostoma quadripartitum var. *subintegrum* Stephani, Ic. Hep., *Blepharostoma* no. 10 b. (Nomen nudum.)

Caulis parvus vel mediocris, erectus, radialis, fuscus, irregulariter longe ramosus; folia caulina transversa, ad 3 cm longitudine, quadrifida, segmentis ad basim utrimque instructa; segmenta longa, marginibus integris vel rare paucidentatis; amphigastria similia. Bracteae femineae quadrifidae et segmentis et dentibus ad basim utrimque instructae, segmentis validis lanceolatis, oppositis, setosis, setis simplicibus. Bracteolae similes. Inflorescentiae masculinae et sporophyta desunt.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3. T. QUADRIPARTITUM

4. T. SUBINTEGRUM

Plants small, erect, tending to be radially symmetric, dull reddish-brown, in tufts or among other bryophytes; stems slender, to 3 cm long, irregularly branched, the branches infrequent, long, lateral, the half-leaf with two major divisions, at the dorsal base on the branch; stem in transverse section with the cortical cells scarcely smaller than those of the medulla. Rhizoids in fascicles, from the lamina of the underleaves. Line of leaf insertion transverse. Leaves distant, spreading to ascendent, subquadrate in outline, 0.8–0.96 mm long, 0.8 mm wide (including the basal teeth), quadrifid to three-fifths of their length; segments long, lanceolate from a base seven to ten cells wide, narrowing to a uniseriate tip five to seven cells long, entire, or with an occasional spine or cilium four to six cells long near the base; lamina with one or more long, lanceolate, spreading teeth on one or both sides near the base; cells of the segment tips mostly 36 × 20–24 μ, the cells of the lamina 27–36 × 18 μ, the trigones inconspicuous, the cuticle weakly striolate. Underleaves similar, scarcely smaller. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or a branch, the bracts and bracteoles in three to five or more series, the bracts concave, with shorter segments bearing more spines than the leaves, the lamina with frequent superficial spines on the ventral surface; bracteoles plane; antheridia one or two, in the axils of the bracts. Female inflorescence terminal on the stem or branch, occasionally with one or two innovations, the bracts and bracteoles similar, those of the inner series larger than the leaves, the margins and segments with many opposite pairs of spines or cilia, the lamina with ciliate and toothed margins, the long basal teeth with opposite spines. Perianth and sporophyte not seen. Fig. 4, a–g.

Habitat: On humus.

PATAGONIA—TIERRA DEL FUEGO: Puerto Bueno, *Dusén 46* (type G); Magellan Straits, *Warnstorf 11* p.p.; Fuegia, *Halle* (G).

The species is readily distinct from the other members of this genus because of the very long segments with few or no marginal teeth. It is perhaps most like *T. quadrifidum* Mitten of New Zealand but the plants of the latter species have less brown pigmentation, the quadrifid leaves have no marginal spines or cilia on the segments or the lamina, and the segments are not so long, the uniseriate tip is of only two or four cells. The male bracteoles of *T. quadrifidum* have entire margins and no superficial cilia, the female bracts and bracteoles of the two species are alike. There are no reports of *T. quadrifidum* in South America.

5. **Temnoma pungens** (Herzog) Fulford, comb. nov.

Blepharostoma pungens Herzog, Revue Bryol. Lichénol. 29: 189. *f. 2, a–e.* 1960.

Plants small, erect, radially symmetric, reddish-brown, scattered among other bryophytes; stems slender, to 3 cm long, simple or very rarely branched; stems in transverse section with the cortical layer scarcely different from the medulla.

FIG. 3. *Temnoma quadripartitum.* 3 a. Female inflorescence, × 133. 3 b. Stem, lateral view, × 133. 3 c. A segment of the leaf, × 300. 3 d. Underleaf on a stem, × 133. 3 e. Branched tip of a rhizoid. 3 f. Male inflorescence, × 133; B, bract. 3 g. Portion of the mouth of the perianth, × 350.

FIG. 4. *T. subintegrum.* 4 a. Stem, lateral view, × 80. 4 b. Leaf, × 80. 4 c. Segment of a leaf, × 150. 4d. Underleaf, × 80; R, area of rhizoids. 4 e. Portion of a transverse section of a stem, × 350. 4 f. Female bract of an intermediate series, × 80. 4 g. One segment of a female bract of the innermost series, × 133.

Rhizoids not seen. Line of leaf insertion transverse. Leaves distanct, erect-spreading, rectangular, quadrate or cuneate, the lateral margins entire or occasionally with a weak tooth, quadrifid (occasional leaves trifid) to one-half or three-fourths of their length; segments six to eight cells long, uniseriate from a 2- or 3-celled base, straight, spreading, the cells 36–50 × 18 μ, the tip cells longest, the cuticle coarsely striate; lamina two to four rows of cells high, the cells mostly 36 × 18 μ, the walls uniformly thickened, the cuticle coarsely striate. Underleaves like the leaves or occasionally slightly smaller. Plants dioicous. Male inflorescence terminal, the bracts and bracteoles in few pairs, the bracts similar to the leaves but the lamina more rows of cells high, the margin 1- or 2-toothed; antheridia solitary in the axils of the bracts. Female inflorescence terminal, with one innovation, the bracts and bracteoles similar, more elaborate than the leaves, larger, the outermost series with a long tooth on each side of the lamina, the innermost series with triangular segments, with one or more cilia, singly or in opposite pairs near the base (as in the preceding species), the margins of the lamina dentate and ciliate; archegonia 10 to 15. Perianth (immature) mouth ciliate, the cilia two to four cells long. Sporophyte not seen. Fig. 5, a–j.

Habitat: On soil among other bryophytes.

PATAGONIA—TIERRA DEL FUEGO: Chaihuín-Colún, Alerzal, 500 m, *G. H. Schwabe 26* p.p (♂) (type Hb. Herzog); Gulf of Peñas, Challenger Exp., without collector's name (NY).

The species is the most simplified member of the genus in America and represents the end line in a reduction series from *T. quadrifidum* possibly through *T. subintegrum*. The vegetative plants of the three are so different from one another that they scarcely suggest a close relationship. However, the patterns of the female bracts and bracteoles are identical in two and quite similar but reduced in *T. pungens*.

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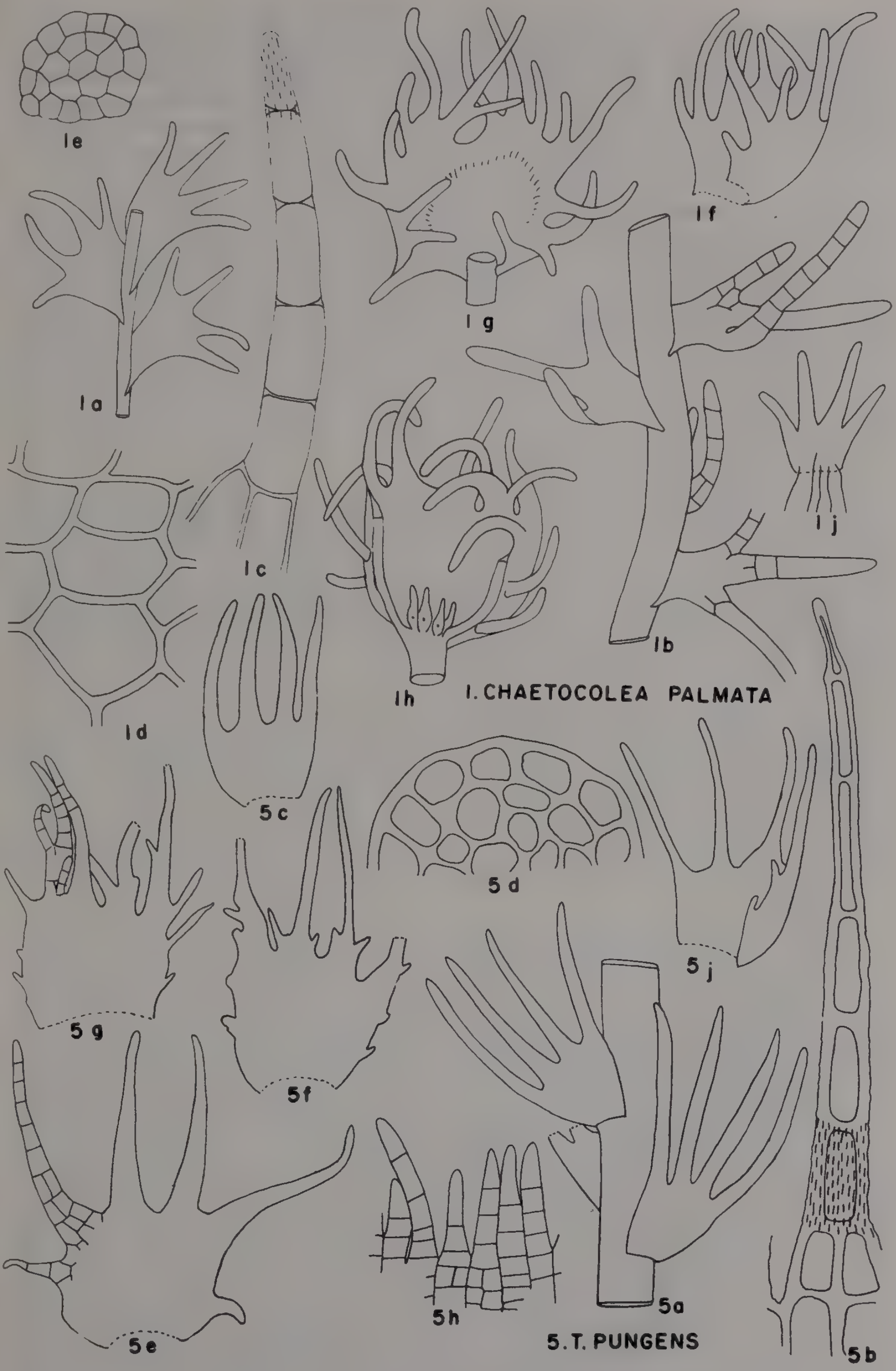
FIG. 5. *Temnoma pungens*. 5 a. Stem, dorsal view, × 33. 5 b. Leaf segment, × 350. 5 c. Underleaf, × 33. 5 d. Portion of a transverse section of a stem, × 350. 5 e. Female bract of the outer series, × 33. 5 f. Female bract of the intermediate series, × 33. 5 g. Female bract of the innermost series, × 33. 5 h. Portion of the perianth mouth (immature), × 165. 5 j. Male bract, × 33.

FIG. 5 j after Herzog, 1960.

FIG. 1. *Chaetocolea palmata*. 1 a. Portion of a stem, dorsal view, × 50. 1 b. Juvenile stem, × 160. 1 c. Tip of a segment, × 350. 1 d. Cells of the lamina of the leaf, × 350 1 e. Transverse section of a slender stem, × 350. 1 f. Female bract, × 65. 1 g. Female bract of an inner series, × 65. 1 h. Innermost female bract and stem structure surrounding the archegonia, × 65. 1 j. Underleaf, × 50.

FIGS. 1 a, f, g, h, j after Spruce, 1885.


1e
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1. CHAETOCOLEA PALMATA
5c
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5. T. PUNGENS
5b

CHAETOCOLEACEAE Fulford

Caules fulvi, irregulariter ramosi, ramis intercalaribus in amphigastriarum axillis; folia succuba, quadrifida. Amphigastria quadrifida, minora; inflorescentia masculina apicalis vel in cauli intercalaris; antheridia in axillis bractearum; inflorescentia feminea apicalis in cauli cum innovationibus, bracteis bracteolisque ciliatis. Perianthium (?) pluriseriatum, urceolatum, ciliis superficialibus instructum, ore ciliato. Sporophyta non visa.

Plants brownish-green to brown, irregularly branched; branches ventral-intercalary, in the axils of the underleaves, rarely lateral [Spruce]. Line of leaf insertion oblique, the leaves succubous. Leaves quadrifid to the middle (some trifid). Underleaves smaller, quadrifid (trifid). Male inflorescence terminal but becoming intercalary on the stem; antheridia in the axils of the bracts. Female inflorescence terminal on the stem, with subfloral innovations, the bracts and bracteoles in several series, the structure surrounding the archegonia urn-shaped, several layers thick, the surface ciliate, the mouth broad, long-ciliate. [Spruce, 1885.]

Type genus: *Chaetocolea* Spruce.

Until more material of the mature female inflorescence is available for study, the interpretation of the structure which surrounds the archegonia and young sporophyte is open to question. The relationship of this taxon to other taxa is dependent in a large part on the kind of shoot/sporophyte relationship and surrounding structures. Since the details of the structures is not known, this taxon has been set apart as a separate family. The immature structures that Spruce has figured indicate that it is distinct.

Chaetocolea Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 346. 1885.

The genus is monotypic and the description of the species fully covers the genus.

Type species: *Chaetocolea palmata* Spruce, 1885.

1. **Chaetocolea palmata** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 346. *pl. 12.* 1885.

Plants small, reddish-brown to dark brown, ascendent, in tufts or mats; stems slender to filiform, to 5 cm long, with leaves 0.4 mm or more wide, sparingly branched; branches ventral-intercalary, in the axils of the underleaves [sometimes lateral–Spruce], leafy; stems in transverse section six to nine cells in diameter, the cells more or less alike. Rhizoids colorless, from the lower part of the underleaves. Line of leaf insertion oblique, the leaves succubous. Leaves distant, to approximate on robust stems, more or less concave, cuneate, 0.8–0.9 mm long, 0.4 mm wide, the margins entire, quadrifid (sometimes three- to five-parted) to the middle; segments subulate to narrowly triangular, two to six cells broad at the base, tapering to the uniseriate tip of four to six cells; cells of the lamina large, 24–36 × 20–24 μ, thin-walled, the trigones conspicuous, cells of the segments 36–40 μ, the cuticle striolate. Underleaves smaller, of similar form. Male inflorescence terminal on the stem, becoming intercalary, the bracts and bracteoles in four to six pairs, the bracts similar to the leaves, the lamina larger concave, the segments unchanged, the bracteoles like the underleaves; antheridia solitary, in the axils of the bracts. Female inflorescence terminal on the stem [after Spruce; with one innovation, the bracts and bracteoles in several series, larger than the leaves, the lateral margins ciliate the segments branched and ciliate, the innermost series adnate to the perianth, the ciliate segments free. Perianth emergent, cup-form, nearly hemispherical, the mouth large, fringed with many cilia]. Fig. 1, a–j.

Habitat: not stated.

ECUADOR: Mount Tungurahua, ***Spruce*** **(type Manch, isotype G)**
PERU: Cuzco: La Convención, ***Bues 612 b*** **(NY)**

The illustrations of the perianth which were made by Spruce from the original material suggest that the shoot/sporophyte relationship might be interpreted differently in the light of our present knowledge. Whether a perianth is actually formed can only be determined after material bearing young or older sporophytes is available.

ISOTACHACEAE R. Hatcher, Nova Hedwigia **2**: 579. 1960.

Leafy stems prostrate to ascending or erect, nearly radial to strongly dorsiventral in aspect, simple or irregularly branched; branches leafy, ventral-intercalary, in the axils of the underleaves or as subfloral innovations in the axils of the female bracteoles. Stem in transverse section with a band of one to three layers of small, thick-walled cells surrounding a medulla of large thin-walled cells. Line of leaf insertion transverse to oblique, the leaves incubous. Leaves bilobed (rarely tri- or quadrilobed) to one-half of their length or less. Underleaves the size of the leaves or smaller. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts concave, the bracteoles like the underleaves; antheridia in the axils of the bracts. Female inflorescence terminal on the stem or a branch, the bracts and bracteoles like the leaves and underleaves, larger, or the innermost series smaller, attached to the perigynium. Shoot/sporophyte relationship a shoot-calyptra surrounded by a thick-walled, hollow, cylindric perigynium with a very short, reduced perianth at the tip. Capsule cylindric-ovoid, the four long valves twisted when open; wall of three or four layers, the cells of the outer layer large, those of the inner layers smaller, thick-walled; elaters long, tapering at the ends.

Type genus: *Isotachis* Mitten.

The family is monogeneric and the species are limited almost entirely to the Southern Hemisphere. There are 16 species in South America.

Isotachis Mitten in J. D. Hooker, Bot. Antarct. Voy. **2**(2): 148. 1855..

Leafy stems small to robust, pale green or pale rose to dark red, magenta, or brown, prostrate, ascending or becoming erect, in tufts, mats, cushions, or scattered among other bryophytes, simple to irregularly branched below, the branches leafy, of unlimited growth, ventral-intercalary, in the axils of underleaves or as subfloral innovations from the female bracteoles; stem in transverse section with a medulla of thin-walled cells surrounded by one to three layers of smaller, usually thick-walled cortical cells. Rhizoids when present colorless, in fascicles from the basal part of the underleaves. Line of leaf insertion oblique, the leaves incubous. Leaves ovate, ovate-truncate, oval, or orbicular in outline, symmetric or asymmetric, bifid to one-half of their length into two equal or subequal triangular, entire to coarsely dentate or ciliate segments; cells of the lamina irregularly rectangular in outline, or quadrate near the margins and in the segments, the walls thin to more or less thickened, with or without trigones and intermediate thickening, the cuticle smooth to striolate-papillose. Underleaves nearly equal to the leaves or smaller, approximate or imbricate, occasionally reflexed, symmetric, bifid, the margins as in the leaves . Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts similar to the leaves, the lamina concave, the bracteoles similar to the underleaves; antheridia large, globose, mostly in pairs in the axils of the bracts, the stalk six to eight cells long. Female inflorescence terminal on the stem or branch, the bracts and bracteoles in three series, symmetric or nearly so, similar to the leaves, larger, often more deeply divided and more strongly toothed, the inner series sometimes smaller, often adnate and carried up on the perigynium; archegonia 8–10; sporophyte enclosed in a slender, hollow, cylindric, thick-walled perigynium with a very short, reduced perianth at the top. Shoot/sporophyte relationship a free, fleshy shoot-calyptra with old archegonia over its surface. Sporophyte capsule ovoid-cylindric, the four valves spirally twisted, the wall of three layers, the outermost layer of large cells with radially thickened walls, the two inner layers of smaller cells with both radial and tangential thickenings; seta long, thick; elaters long, tapering at the ends, bispiral, brown; spores small, brown, smooth.

Type species: *Isotachis lyallii* Mitten in J. D. Hooker, Bot. Antarct. Voy. **2**(2): 149. 1855.

A high degree of variability in size and color of the plants and in the size and configuration of the leaves and underleaves and the teeth of their margins is present in plants of many of the species. The latter was well illustrated by Hatcher (1960), who made a comparative study of large numbers of the leaves and underleaves of certain of the species.

Some of the species formerly included in the genus have the general appearance and stem structure of an *Isotachis* but they produce perianths. The genus *Triandrophyllum* was one of these groups of species. A few others have not yet been transferred since the problem of relationships has not satisfactorily been solved because the material is sterile. These latter, together with those species for which no type has been available, are listed after the descriptions of the species.

Key to the Species

1. Leaves without teeth or with a few scattered teeth.
2. Leaves and underleaves more or less the same length, or the underleaves only slightly smaller.
3. Leaves different from the underleaves in outline; underleaves oblong, entire to emarginate; leaf sinus very broad, the lobes widely divergent. 12. *I. splendens.*
3. Leaves and underleaves of similar form.
4. Leaves and underleaves orbicular, cucullate, the very short segments incurved; plants small, dark brown, compact, more or less radially symmetric. 16. *I. spegazziniana.*
4. Leaves and underleaves ovate to ovate-truncate, sometimes broadly so.
5. Underleaf margin entire.
6. Segments of the leaves and underleaves divergent; plants small, red to reddish-green; leaves bifid to one-half of their length. 1. *I. tenax.*
6. Segments of the leaves and underleaves not conspicuously divergent; leaves bifid to one-sixth of their length or less.
7. Sinus of the underleaf narrow, U-shaped, the segments acute, connivent; leaves imbricate, patent; plants dark reddish-brown. 15. *I. obtusa.*
7. Sinus of the underleaf broader, V-shaped, the segments rounded; leaves canaliculate, widely spreading; plants dark purple-brown. 14. *I. lacustris.*
5. Some underleaves with one or a few scattered marginal teeth.

        - 6. Segments of the leaves and underleaves divergent; leaves bifid to one-half of their length; plants small, red to reddish-green. 1. *I. tenax.*
        - 6. Segments of the leaves and underleaves erect or only slightly spreading; median leaf cells thin-walled.
          - 7. Underleaf margins incised-toothed with several long, coarse teeth; median leaf-cells averaging 58 × 25 μ. 9. *I. grossidens.*
          - 7. Underleaf margins with shorter teeth.
            - 8. Plants small, compact, dark brown to greenish-brown; median leaf cells averaging 47 × 16 μ. 11. *I. fragilis.*
            - 8. Plants larger, pale green to greenish-brown; leaf-cells 60–90 × 20–30 μ. 4. *I. madida.*
- 2. Underleaves smaller and shorter than the leaves.
  - 3. Underleaves usually with one very large tooth on one or both sides, rarely without teeth.
    - 4. Lateral tooth of the underleaf as large as the segment; leaf segments one-half to one-third the length of the leaf, broadly triangular; median leaf-cells long, thin-walled; plants large, flaccid, green. 13. *I. obtusiloba.*
    - 4. Lateral tooth of the underleaf smaller than the segment; leaf sinus usually broad, lunulate; plants of small to medium size, often reddish to reddish-brown.
      - 5. Leaves tending to be canaliculate, spreading to reflexed; median leaf-cells averaging 45 × 23 μ. 2. *I. multiceps.*
      - 5. Leaves and underleaves closely imbricate; median leaf-cells averaging 80 × 30 μ. 3. *I. erythrorhiza.*
  - 3. Underleaves with several teeth on the lateral margins.
    - 4. Leaf margins with a single row of somewhat enlarged cells, the long axis at a right angle to the margin; leaf sinus V-shaped to lunulate. 10. *I. inflata.*
    - 4. Leaf margins without a row of enlarged cells.
      - 5. Underleaf segments and the lateral teeth long.
        - 6. Underleaves more or less quadrate, bifid to one-half of their length; teeth of the margins long, coarse; plants brownish-green. 9. *I. grossidens.*
        - 6. Underleaves rounded to orbicular or subrectangular, bifid to less than one-half of their length, the marginal teeth long, slender.
          - 7. Underleaves orbicular, the segments as such not conspicuous. 7. *I. auberti.*
          - 7. Underleaves orbicular to subrectangular.
            - 8. Segments long, narrow, blunt, the sinus narrow, U-shaped; marginal teeth slender. 6. *I. haematodes.*
            - 8. Segments shorter, the sinus broad, U-shaped, marginal teeth broad, triangular. 5. *I. serrulata.*
      - 5. Underleaf segments and the lateral margins sparsely to abundantly dentate, denticulate, serrulate by a single cell, or ciliate-dentate; underleaves oval, orbicular, ovate-truncate, or subrectangular.
        - 6. Median leaf-cells averaging 47 × 16 μ; plants small, compact, dark brown to greenish. 11. *I. fragilis.*
        - 6. Median leaf-cells more than 50 μ long; plants larger.
          - 7. Segments of the underleaves broadly triangular.
            - 8. Cells of the median portion of the leaf without intermediate thickenings in the walls; plants greenish to greenish-brown.
              - 9. Leaf sinus broad, tending to be lunulate; leaf margin with one or two teeth. 10. *I. inflata.*
              - 9. Leaf sinus narrow, V-shaped; leaf margin with three to five teeth. 4. *I. madida.*
            - 8. Cells of the median portion of the leaf with conspicuous intermediate thickenings in the cell walls.
              - 9. Intermediate thickenings and trigones conspicuous, distinct, large, in the segments knot-like. 5. *I. serrulata.*
              - 9. Intermediate thickenings and trigones more or less coalesced into an uneven layer of secondary thickening. 6. *I. haematodes.*
          - 7. Segments of the underleaves narrow-triangular to ligulate, the apex broad.
            - 8. Underleaf margin, including the sinus, appearing to be scalloped and serrulate to denticulate, the teeth mostly one-celled, usually red-tipped. 8. *I. lindigiana.*

8. Underleaf margin dentate to dentate-ciliate, the teeth two to several cells long, often red-tipped. 6. *I. haematodes.*

1. Leaves with numerous marginal teeth (rarely only a few).

2. Margins of the underleaves, including the sinus, appearing scalloped, serrulate to denticulate, the teeth mostly of one cell, reddish. 8. *I. lindigiana.*

2. Margins of the underleaves with larger teeth.

3. Teeth of the underleaves mostly long, slender.

4. Underleaves oblong-ovate, the sinus narrow, U-shaped, the segments erect. 6. *I. haematodes.*

4. Underleaves more or less orbicular, the sinus shallow, broad, the segments as such, not conspicuous. 7. *I. auberti.*

3. Teeth of the underleaves mostly broad, shorter.

4. Underleaves bifid to one-half of their length, the margins often incised with one to four sharp teeth; plants pale, greenish-brown. 9. *I. grossidens.*

4. Underleaves bifid to one-third or one-half of their length, the margins with usually four to many teeth.

5. Plants pale green to greenish-brown; median leaf-cells without intermediate thickenings. 4. *I. madida.*

5. Plants reddish-brown to red; median leaf-cells with conspicuous intermediate thickenings.

6. Cells of the leaves and underleaves with large, conspicuous, knot-like trigones and intermediate thickenings; underleaves nearly as broad as long. 5. *I. serrulata.*

6. Cells of the leaves and underleaves with the trigones and intermediate thickenings tending to be coalesced, forming an uneven layer of secondary thickening; underleaves longer than broad. 6. *I. haematodes.*

1. Isotachis tenax Stephani, Symb. Antill. **3**: 277. 1902.

Plants small, bright red to reddish-brown, prostrate to ascending, in tufts or among other bryophytes; stems slender, 0.5–1 mm long, with leaves to 1 mm wide, irregularly branched, the branches long; stem in transverse section ten or more cells in diameter, the cortical cells in one or two layers, the walls very thick. Rhizoids not seen. Leaves spreading, truncate-ovate, bifid to one-half of their length, the segments triangular, acute to blunt, widely divergent, the sinus V-shaped, the leaf margin entire; cells of the median portion of the lamina averaging 33 × 21 μ, the walls thick, the knot-like intermediate thickenings conspicuous, the cuticle minutely striolate-papillose. Underleaves bifid, similar to the leaves, only slightly smaller, the margins entire or more rarely with one to three coarse teeth on one or both sides. Male and female inflorescences and sporophyte not seen. Fig. 1, a–e.

Habitat: On soil.

GUADELOUPE: s.l, *Duss 550* (type G, isotype FH).

The species seems to be endemic to Guadeloupe where it has also been reported by Pagán (1942) and Stephani (1904).

2. Isotachis multiceps (Lindenberg & Gottsche) Gottsche, Mex. Leberm. 105. *pl. 14, f. 1–8.* 1863.

Jungermania multiceps Lindenberg in G. L. & N. Syn. Hep. 680. 1847.
Jungermania conduplicata Lindenberg in G. L. & N. Syn. Hep. 680. 1847.
Isotachis parva Stephani, Arq. Mus. Rio de Janeiro 13: 113. 1903.
Isotachis coilophylla Herzog, Repert. Spec. Nov. 21: 25. *pl. 1, f. 2.* 1925.

Plants of small to medium size, red to brownish-green, prostrate to ascending, in tufts or among other bryophytes; stems 1.0–1.5 cm long, with leaves to 1.5 mm wide, simple to irregularly branched, the branches long, usually from near the base of the stem; stems in transverse section ten to twelve cells in diameter, the unistratose cortical cells smaller and with thicker walls than those of the medulla. Rhizoids in tufts from the lower part of the lamina of the underleaves. Leaves spreading, a little decurved, broadly ovate to orbicular, asymmetric, canaliculate, bifid to one-third or one-half of their length, the sinus broad, broadly triangular, the segments triangular from a broad base, the leaf-margins entire or with an occasional short tooth near the base; cells of the median portion of the leaf averaging 45 × 23 μ, the walls thick, intermediate thickenings conspicuous, the cuticle smooth to minutely papillose. Underleaves usually half as long, of similar shape, the lateral margins entire or with one, rarely two, large teeth on both sides. Female inflorescence terminal on the stem, the bracts and bracteoles similar to the leaves, larger. Perigynium conic-cylindric, to 4 mm long, straight to slightly arcuate. Male inflorescence and sporophyte not seen. Fig. 2, a–d.

Habitat: On soil.

JAMAICA: Blue Mountain Peak, *Evans 234* (BM, NY), *243* (BM, FH), *Orcutt 2913, 5319* (BM, US); Cinchona, *Harris* (BM); Hardwar Gap. *Evans 179* (NY); Hardwar Gap to Caledonia Peak, *M. Farr 684* (IJ); Newhaven Gap, *Evans 154* (BM, FH, NY, Y).

PUERTO RICO: Adjuntas, *Pagán 951* (NY); Joyuya Road, *Pagán 136* (FH).

ST. KITTS: Mt. Misery, *Box* (BM).

GUADELOUPE: Soufrière, *Le Gallo 256* (Hb. Le Gallo).

MEXICO: Sempoaltepec, *Liebmann 137b* (type S-PA, isotype BM); Chiapas: near Las Casas, 7300 ft., *Sharp 3444* (TENN); Hidalgo: near Mapastepec, *Sharp 4587;* Apulco, 5600 ft., *Sharp 4138* p. p. (TENN); Puebla: w of Huauchinango, 5100 ft., *Sharp 922* (TENN); Tulancingo, 6200 ft., *Sharp 987* (TENN); Veracruz: below Atzalan, 5500 ft., *Sharp 5562, 5583* (TENN).

COSTA RICA: Cerros de Zurqui, *Standley & Valerio 50316* (Hb. Herzog); s.l., *Polakowsky 468* (BM).

COLOMBIA: Mt. de Moro, *Lindig 206, 207, 210* (G); Los Gagues, *Alston 7494* (BM). Cauca: Páramo de Las Papas, *Bischler 802* (COL).

BRAZIL: Serra de Itatiaia, *Dusén 494,* type of *I. parva* (type G, isotype FH); Serra dos Orgãos, Morro Assu, *Lützelburg 6035b,* type of *I. coilophylla* (Hb. Herzog); Rio de Janeiro, without collector's name, ex Hb. Liebmann, type of *J. conduplicata* (S-PA).

Additional reports in the literature include: Guadeloupe (Stephani, 1904), Colombia (Gottsche, 1864) and Brazil (Spruce, 1888a; Stephani, 1893b).

3. **Isotachis erythrorhiza** (Lehmann & Lindenberg) Stephani, Bull. Soc. Bot. Fr. **36**: 185. 1832.

Jungermannia erythrorhiza Lehman & Lindenberg in Lehmann, Pug. Pl. 4: 44. 1832.
Isotachis subtruncata Stephani, Spec. Hep. 3: 662. 1909.

Plants of medium size, reddish to brownish-green, mostly prostrate, in mats; stems to 2 cm long, with leaves to 2 mm broad, occasionally branched; stems in transverse section ten or twelve cells in diameter, the cortical cells in one layer, mostly smaller and with slightly thicker walls than those of the medulla. Rhizoids long, in tufts on the lamina of the underleaves of the lower part of a stem. Leaves imbricate, appressed, rarely erect-spreading, orbicular, bifid to one-fifth of their length, the segments short, triangular from a broad base, the sinus lunulate or rarely obtusely triangular; leaf margins entire or with one or two obscure teeth on one or both sides; cells of the median part of the leaf long, averaging 20 × 30 μ, the walls uniformly thickened or with intermediate thickenings, the trigones small, inconspicuous, the cuticle smooth; the marginal cells smaller, with thicker walls. Underleaves smaller than the leaves, cuneate, bifid to one-half of their length, the segments narrowly triangular, the margins entire or with one or two teeth on one or both sides, the cells as in the leaf. Female inflorescence terminal on the stem, the bracts and bracteoles similar to the leaves and underleaves, larger, the bracts long, oval, the margins entire, bifid to one-third of their length, the bracteoles more deeply cut, the segments lanceolate. Perigynium 4–5 mm long, straight to slightly arcuate. Male inflorescence and sporophyte not seen. Fig. 3, a–e.

Habitat: On soil.

PUERTO RICO: Ajuntas, *Pagán 135* (NY).

GUADELOUPE: Rouge River, *Husnot 231b* (BM, FH); s.l., *l'Herminier* (BM); s.l., *Marie* (BM).

DOMINICA: Roseau Valley, *Elliott* (BM); s.l., *Elliott 1145*, type of *I. subtruncata* (G), *Elliott 1172* (G); s.l., *Elliott 1798* (BM); Grand Soufrière, *Elliott 872* (BM); s.l., *Eggers* (NY).

MARTINIQUE: s.l., *Le Jolis* (BM); s.l., *Perrottet* (BM).

ST. VINCENT: s.l., without collector's name, (type ex Hb. Lehmann, NY); s.l., ex Hb. Meissner (G).

BARBADOS: s.l., without collector's name, ex Hb. Mitten (NY).

The species has been reported in the literature from the following additional localities: Antilles (Bescherelle, 1893; Stephani, 1901d), Puerto Rico and Guadeloupe (Pagán, 1939, 1942; Stephani, 1904) and Dominica (Pearson, 1922; Spruce, 1895).

4. Isotachis madida (Hooker f. & T. Taylor) Mitten in J. D. Hooker, Bot. Antarctic Voy. **2**(2): 149. 1855.

Jungermannia madida Hooker f. & T. Taylor, London Jour. Bot. **3**: 465. 1844.
Isotachis fusca Stephani, Sv. Vet.-akad. Handl. 46^{9}: 68. *f. 25, d–e.* 1911.
Isotachis pallens Stephani, Sv. Vet.-akad. Handl. 46^{9}: 70. *f. 25, h–l.* 1911.
Isotachis striolata Stephani, Sv. Vet.-akad. Handl. 46^{9}: 71. *f. 27, c–d.* 1911.
Isotachis aequifoliata Stephani, Spec. Hep. **6**: 349. 1924.
Isotachis flavicans Stephani, Spec. Hep. **6**: 351. 1924.

Plants large, pale green to greenish-brown, prostrate to ascending, in tufts or mats; stems robust, 3–8 cm long, with leaves 2–3 mm wide, irregularly branched; stems in transverse section 14–16 cells across, the cortical cells in one or two layers, with very thick walls. Rhizoids not seen. Leaves imbricate, spreading, asymmetric, ovate, bifid to one-third or one-half of their length, the segments acute, triangular from a broad base, the sinus V-shaped; leaf margins entire or sparingly dentate in the upper half, rarely also denticulate; cells of the median portion of the leaf 60–90 × 20–30 μ, the walls uniformly thickened,

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FIG. 1. *Isotachis tenax.* 1 a. Stem, ventral view, × 50. 1 b. Leaf, × 40. 1 c. Cells from the median portion of the leaf, × 350. 1 d. Underleaf, × 50. 1 e. Portion of a transverse section of a stem, × 350.

FIG. 2. *I. multiceps.* 2 a. Stem, lateral view, × 20. 2 b. Leaf, × 40. 2 c. Cell from the median portion of a leaf, × 350. 2 d. Underleaf, × 40.

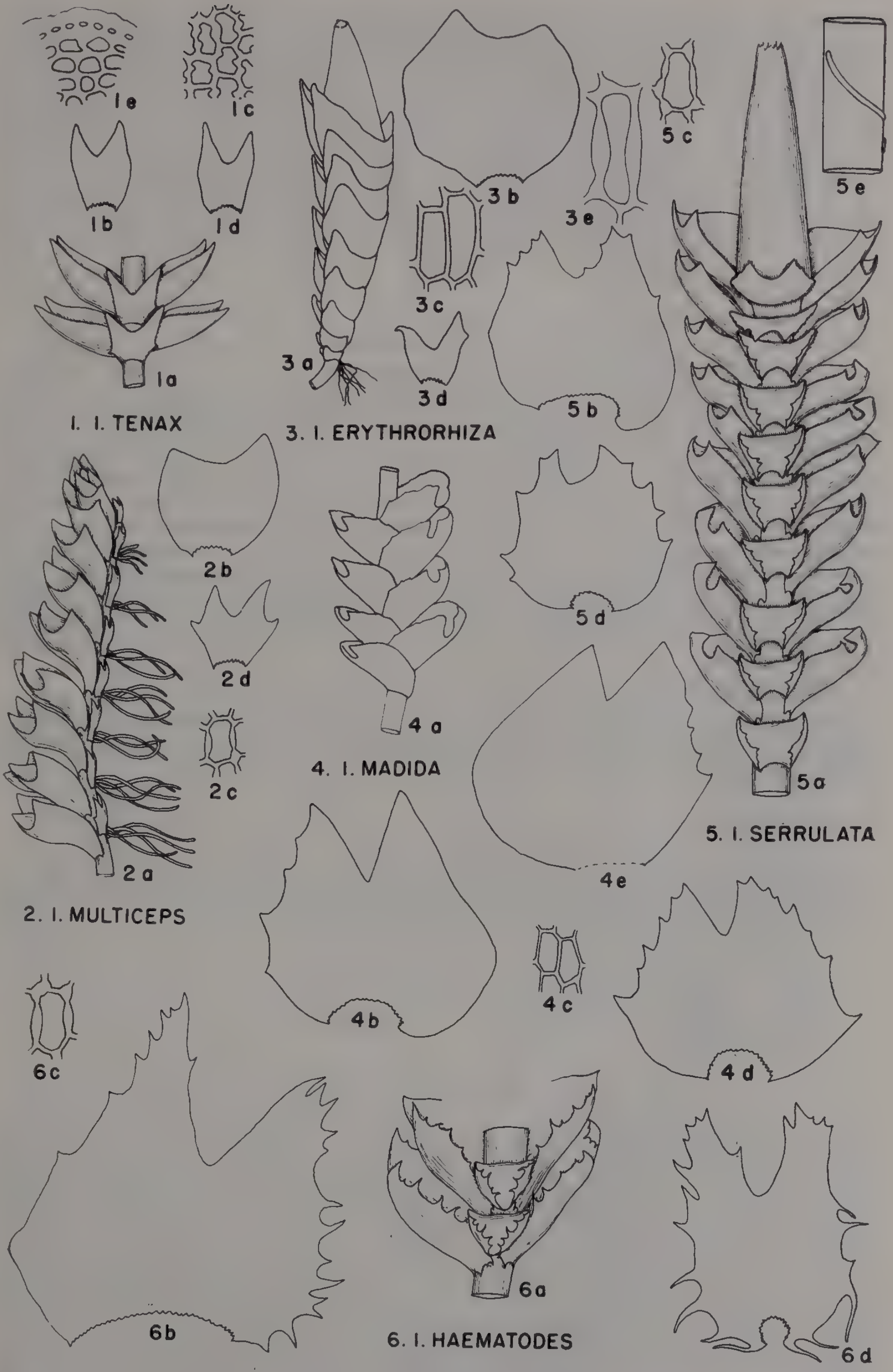
FIG. 3. *I. erythrorhiza.* 3 a. Leafy stem with a mature perigynium, × 20. 3 b. Leaf, × 40. 3 c. Cells from the median portion of a leaf, × 180. 3 d. Underleaf, × 40. 3 e. Cell from the median portion of a leaf of another plant, × 250.

FIG. 4. *L. madida.* 4 a. Stem, dorsal view, × 9. 4 b. Leaf, × 18. 4 c. Cells from the median portion of a leaf, × 165. 4 d. Underleaf, × 18. 4 e. Female bract, × 18.

FIG. 5. *I. serrulata.* 5 a. Leafy stem with a mature perigynium, × 9. 5 b. Leaf, × 18. 5 c. Cell from the median portion of a leaf, × 165. 5 d. Underleaf, × 18. 5 e. Leaf insertion on the stem, lateral view.

FIG. 6. *I. haematodes.* 6 a. Stem, ventral view, × 9. 6 b. Leaf, × 18. 6 c. Cell from the median portion of a leaf, × 165. 6 d. Underleaf, × 18.

Drawn after Hatcher, 1961.


1e
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6b
6c
6d

1. I. TENAX

3. I. ERYTHRORHIZA

2. I. MULTICEPS

4. I. MADIDA

5. I. SERRULATA

6. I. HAEMATODES

the cuticle smooth to minutely striolate-papillose; cells of the segments and leaf margins smaller. Underleaves smaller than the leaves, broadly ovate to orbicular, bifid to one-fifth or one-half of their length, the sinus V- or U-shaped, the segments erect, the margins with sharp teeth in the upper half, or rarely entire. Plants dioicous. Male bracts and bracteoles terminal but becoming intercalary in position, in 12–15 series, similar to the leaves, the lamina concave; antheridia large, globose, in pairs in the axils of the bracts. Female inflorescence terminal on the stem, the bracts and bracteoles similar to the leaves and underleaves, larger. Perigynium to 5 mm long, arcuate. Sporophyte not seen. Fig. 4, a–e.

Habitat: On soil.

COLOMBIA: Bogotá, *Weir* (as *I. mascula*) (NY); Antioquia, *Bischler 106* (COL).

BOLIVIA: s.l., *Herzog 2848,* type of *I. aequifoliata* (G).

PATAGONIA—TIERRA DEL FUEGO: Corral, *Dusén 501* (NY, G), *Dusén 507* (FH); s.l., *Krause* (as *I. complicata*) (S-PA), *Krause* (S-PA, G); s.l. *R. Thaxter,* as *I. halleana* (FH), s.l., *R. Thaxter 145* (as *I. pallens*) (FH); Valparaiso, *Dusén 141* (NY); Taliahuano, *Dusén 203* (NY); Concepción, *Dusén 192* (NY); Valdivia, *Hosseus 57* (as *I. leptodictyon*), *840* (Hb. Herzog); Guaitecas I., *Dusén* (NY); Chilloe I: Palmaiquen, *Junge 2220* (Hb. Herzog), Puerto Octai, *Dusén 531* (G); Puerto Bueno, *Dusén 54* (as f. *subintegra*) (G); Puerto Frias, *W. Schiller* (as *I. striolata*) (S-PA); Lago los Santos Cayutue, *Wolfhügel* (as *I. dentata*) (S-PA); Riesco I., *Skottsberg 133,* type of *I. striolata* (S-PA); s.l., *Skottsberg 739,* type of *I. flavicans* (G); s.l., *Skottsberg 882,* type of *I. fusca* (G); s.l., *Skottsberg,* type of *I. pallens* (G); Straits of Magellan, *Dusén 242* (G); Desolation I., Puerto Angosta, *Dusén 399* (NY); s.l., *Dusén 400* (as f. *subintegra*), *Dusén 197* (G); s.l., *Bescherelle 909* (VER); Cape Horn, ex Hb. Mitten (NY); Cape Horn, *Hooker* (type NY, isotype BM); Staten I., s.l., *Spegazzini 18* (VER); Cape Foster, without collector's name (BM).

TRISTAN DA CUNHA: *Christopherson & Meyland* (as *I. striolata*) (S-PA).

The additional reports in the literature include the following: Argentina (Kühnemann, 1949), S. Chile (Herzog, Schwabe & Schwabe, 1939; Herzog, 1954; Stephani, 1900 a & b, 1901a, 1903a, 1911), Tierra del Fuego (Massalongo, 1885, 1927), and Cape Horn (Bescherelle & Massalongo, 1889).

5. **Isotachis serrulata** (Swartz) Gottsche, Ann. Sci. Nat. V. **1**: 121. 1864.

Jungermannia serrulata Swartz, Prodr. 143. 1788.
Jungermannia serrulata swartziana Gottsche [?] in G. L. & N. Syn. Hep. 128. 1844.
Isotachis husnoti Gottsche ms. nom. nud.; in Bescherelle, Jour. Bot. Morot **7**: 124. 1893.
Isotachis swartziana Stephani, Spec. Hep. **3**: 665. 1909.
Isotachis urbani Stephani, Spec. Hep. **3**: 667. 1909.
Isotachis hahnii Stephani, Spec. Hep. **3**: 668. 1909.
Isotachis paucidens Stephani, Spec. Hep. **6**: 335. 1924.
Isotachis woronowii Herzog, Beih. Bot. Center. **61**(B): 566. *f. 4, k–s.* 1942.
Isotachis piliflora Herzog, Beih. Bot. Center. **61**(B): 568. f. 4, a–j. 1942.
Isotachis guadeloupensis Gottsche, ms.

Plants very large, pale to dark red or reddish-brown, ascending to erect, in deep tufts or cushions; stems very large, 5–10 cm long, with leaves to 3 mm wide, irregularly branched; stems in transverse section 14–16 cells across, the cortical cells in one or two layers, very thick-walled, surrounding the larger, thinner-walled cells of the medulla. Rhizoids not seen. Leaves patent, imbricate, canaliculate, asymmetric, broadly ovate, bifid to one-fifth or one-fourth of their length; segments broadly triangular, acute, the sinus U- or V-shaped, more or less toothed on the outer margins, the teeth short; margins of the lamina entire or with a few scattered teeth; cells of the median part of the leaf 58–70 × 20–25 μ, the walls with conspicuous intermediate thickenings, the trigones large, rounded, the cell lumina angular-rounded, the cuticle minutely to strongly striolate-papillose; cells of the segments and margin smaller. Underleaves oblong to orbicular, often reflexed above, bifid to one-third of their length, the sinus U-shaped, the margins with one to several coarse teeth above, usually on the outer margins of the segments, the cells as in the leaf. Plants dioicous. Male inflorescence terminal but becoming intercalary in position, the bracts and bracteoles in 10–15 series, similar to the leaves and underleaves, slightly larger, the bracts concave, the bracteoles plane; antherida large, globose, in pairs in the axils of the bracts. Female inflorescence terminal on the stem, the bracts and bracteoles similar to the leaves and underleaves, larger, obovate, the sinus broad, shallow, rounded, the outer margins toothed in the upper half. Perigynium conic-cylindric, to 6 mm long, straight to arcuate, long-ciliate at the top. Sporophyte not seen. Fig. 5, a–e.

Habitat: On soil.

JAMAICA: S.l., *Swartz* (isotypes S-PA, BM); s.l., *Schweinitz*, (as *I. swartziana*) (PHIL); near Cinchona, *Harris, 11024* (as *I. guadeloupensis*) (G, NY); s.l., *Wilds 7* (NY); s.l., *Hansen*, isotype of *I. urbani* (FH); s.l., *Weber 25* (S-PA).

GUADELOUPE: Soufrière, *Duss 130* (as *I. guadeloupensis*) (NY, G), *Le Gallo 226* (Hb. Le Gallo); s.l., *Duss 1209* (as *I. guadeloupensis*) (G); fôret de Baines Jaunes, *Le Gallo 225* p.p., *232* p.p. (Hb. Le Gallo); s.l., *l'Herminier* (as *I. serrulata* var. *procera* (FH); s.l., *Husnot 230*, isotype of *I. husnoti* (FH).

MARTINIQUE: Mt. Pelée, *Duss 294*, (as *I. mascula*) (NY), *Duss*, (as *I. quadeloupensis*) (G), *Duss 370* (as *I. serrulata* var. *swartziana*) (NY); s.l., *Duss 605* (as *I. hahnii*) (G, FH); s.l., *Husnot 228*, type of *I. swartziana* (type G, isotypes FH, NY); s.l., *Husnot 278* (as *I. serrulata* var. *swartziana*) (S-PA); Bois de Colson, *Duss 1209* (as *I. mascula*) (NY); s.l., *Duss 605* (as *I. multiceps*) (NY); s.l., *Hahn 1445*, type of *I. hahnii* (type G, isotype BM).

GUATEMALA: Alta Verapaz, Türckheim (as *I. mascula*) (NY, BM).

COLOMBIA: Bogotá, Weir (NY); Territoria del Caquetá, *Woronow 96*, type of *I. woronowii* (Hb. Herzog), *Woronow 113*, type of *I. piliflora* (Hb. Herzog); Comisaria del Caquetá, *Cuatrecasas 8788c* (US); Antioquia, *Bischler 67* (♀) (COL); Cundinamarco, *Bischler 93* (COL); Cauca: Páramo de Las Papas, *Bischler 739, 789, 793* (COL); Huila-Cauca: Páramo de Las Papas, *Bischler 786, 843* (COL).

BOLIVIA: Sillar, *Herzog*, type of *I. paucidens* (type G, isotype Hb. Herzog); Unduavi, *Rusby 3038* (BM); Yungas, *Rusby 3037* (NY).

The species has also been reported in the literature from the following areas: Jamaica (Boswell, 1887; Swartz, 1806), Antilles of France (Bescherelle, 1893); Guadeloupe (Gottsche, 1875; Pagán, 1942; Stephani, 1904); Dominica (Spruce, 1895); Martinique (Arnell, 1959; Stephani (1904); Brazil (W. J. Hooker & Wilson, 1844; Massalongo, 1911; Spruce, 1888; Stephani, 1893b); and Bolivia (Spruce, 1890).

6. Isotachis haematodes (Lehman & Lindenberg) Gottsche, Ann. Sci. Nat. V. 1: 122. 1864.

Jungermannia haematodes Lehmann & Lindenberg, in Lehmann, Pug. Pl. 4: 42. 1832.
Isotachis ecuadoriensis Stephani, Spec. Hep. **6**: 351. 1924.

Plants large, reddish-green to dark red or reddish-brown, erect or ascending, in tufts or deep cushions; stems stout, 4–12 cm long, with leaves 2–4 mm wide, irregularly branched; stems in transverse section 16–18 cells across, the cortical cells in one or two layers, small, the walls very thick, the cells of the medulla large, with thinner walls. Rhizoids not seen. Leaves imbricate, tending to be concave, asymmetric, ovate, 1.3–3.0 mm long, 0.9–2.6 mm wide, bifid to one-third or one-half of their length; segments typically narrowly triangular, blunt, the sinus narrow, V-shaped; leaf margins including the sinus more or less dentate to ciliate-dentate; cells of the median portion of the leaf 40–82 × 24–36 μ, the walls with intermediate thickenings tending to coalesce with the trigones, the cuticle striolate-papillose; cells of the segments and the leaf margins smaller. Underleaves smaller than the leaves, ovate to orbicular, 0.9–2.4 mm long, 0.6–1.8 mm wide, bifid to one-fourth or one-half of their length, the segments erect, obtuse to acute, the sinus narrow, the margin entire, dentate to ciliate-dentate. Male and female inflorescences and sporophyte not seen. Fig. 6, a–d.

Habitat: On soil.

DOMINICAN REPUBLIC: s.l., *Eggers* (BM).

PUERTO RICO: s.l., *Sintenis* (BM).

GUADELIUPE: Grande Citerne, *Duss 106, 227* (NY); Morne l'Echelle, *Duss 216* (NY, G); Mt. Pelée, *Duss 91a, 125, 243* (NY); Soufrière, *Duss 371* (as *I. serrulata* var. *brasiliana*) (NY); *Husnot 227* (as *I. serrulata* var. *brasiliana*) (NY, G), *Husnot* (as *I. serrulata*) (BM), *Jung* (BM), *l'Herminier* (G); s.l., *l'Herminier* (G, BM); s.l., *Marie* (BM); s.l., without collector's name, ex Hb. Lehmann (isotypes BM, G).

DOMINICA: Grand Soufrière, *Elliott 810, 811* (as *I. serrulata*) (BM), *Elliott 813* (as *I. serrulata* var. *purpurea*) (BM), *Elliott 1829, 1830* (as *I. madida*) (BM), *Elliott 830, 1831a* (BM).

MARTINIQUE: s.l., *Duss 92* (G).

COLOMBIA: Antioquia, *Bischler 16* (COL); Cauca: Páramo de Las Papas, *Bischler 899, 904* p.p. (COL).

ECUADOR: Azuay: Gualaquiza, *Allioni 6540*, type of *I. ecuadoriensis* (G); *s.l., Allioni 717* (G); s.l., *Fraser 2* (BM).

BOLIVIA: Unduavi, *Rusby 3038* (as *I. serrulata*) (NY); s.l., *Herzog 4736* (as *I. ecuadoriensis*) (G).

In addition to the above there are reports in the literature from the French Antilles (Bescherelle, 1893); Guadeloupe (Stephani, 1904); and Martinique (Pagán, 1942; Stehlé, 1957).

7. **Isotachis auberti** (Schwaegrichen) Stephani, Spec. Hep. **3**: 688. 1909.

Jungermannia auberti Schwaegrichen, Hist. Musc. Hep. Prodr. 19. 1814.
Jungermannia serrulata W. J. Hooker, Musc. Exot. **1**: *pl. 88.* 1818. Non *J. serrulata* Swartz 1788.
Isotachis gordoni Stephani, Hedwigia **34**: 49. 1895.

Plants very large, reddish-green, magenta, or dark red, ascending to erect, in deep cushions; stems robust, to 10 cm long, with leaves to 4 mm wide, occasionally branched near the base; stems in transverse section to 14 cells across, the cortical band of one or two layers, thick-walled, the cells of the medulla larger, with thinner walls. Rhizoids not seen. Leaves spreading, asymmetric, broadly ovate to subquadrate, 0.8–2.3 mm long, 0.7–2.0 mm wide, bifid to one-fourth of their length; segments short, triangular, acute to acuminate, the sinus mostly U-shaped; leaf margins including the segments with one to several usually long teeth; cells of the median portion of the lamina averaging $73 \times 28\ \mu$, the walls with elongate intermediate thickenings, the trigones very small or absent, the cuticle minutely striolate-papillose. Underleaves smaller than the leaves, orbicular to subquadrate, 0.7–1.9 mm long, 0.8–1.9 mm wide, bifid to one-fifth of their length, the segments short, narrowly triangular, spreading, often acuminate, the margins of the underleaf long-ciliate-dentate. Female inflorescence terminal, the bracts and bracteoles in several series, larger than the leaves and underleaves, the bracts ovate-truncate, the bracteoles oblong, ciliate-dentate. Perigynium 5–6 mm long, arcuate. Elaters 350–400 μ long, reddish-brown; spores pale reddish-brown, smooth. Male inflorescence not seen. Fig. 7, a–d.

Habitat: On soil.

CUBA: s.l., *Wright* (BM).

DOMINICAN REPUBLIC: s.l., *Eggers* (BM).

GUADELOUPE: s.l., *l'Herminier* (BM); s.l., *Duss 69* (G).

TRINIDAD: s.l., *Crüger* (BM).

BRAZIL: Rio de Janeiro, *Glaziou 1161* (NY), *Glaziou 4536* (NY, S-PA), *Glaziou 11756* (G, NY, BM), *Glaziou 4535* (BM, S-PA), *Glaziou* (FH), *Gardner* (BM), *Dusén 8* (as *I. auberti* f. *aquatica*) (G); *Miers 135* (BM); s.l., *Dusén* (S-PA); s.l., *Mosén 274* (G, S-PA); s.l., without collector's name (as *J. serrulata brasiliensis elongata*) (S-PA); S. Francisco, *Schenk* (BM); Sierra Estrella, *Sellow* (BM, G); Sierra de Cubatão, *Guillemin* (BM), *Lindberg* (as *I. serrulata purpurascens*) (BM); Serra do Mar, *Ule 80* (BM, G); Caraça, *Wainio* (BM), *Wainio 47* (G); Petrópilis, *Rudolph* (BM); Thermopilis, *Lutz 2104* (BM); Itajahy, *Puiggari*, (BM); Blumenau, *Ule 172* (G, BM); s.l., *Ule 165* (G); S. Catarina, *Ule 55* (G); Serra do Orgãos, *Martius 10* (G); s.l., *Beyrich* (S-PA); Apiahy, *Puiggari 686, 762* (G); Caldas, *Regnell 40* (S-PA); Santos Alte da Lima, *Mosén 33* (G, FH, S-PA), *Mosén 83* (NY, S-PA); Alto da Serra, *Hoehne* (Hb. Herzog); s.l., *Glaziou 22607* (BM); s.l., *Sellow* (BM, FH, S-PA); s.l., *Schenk* (BM); s.l., *Raddi* (G); s.l., *Ule 171* (FH, G); s.l., *Gardner 22* (G); s.l., *Wainio* (BM); s.l., *Burchell 2225* (NY); s.l., ex Hb Montagne (S-PA); s.l., *Beyrick* (S-PA); s.l., *Martius* (S-PA); s.l., *Martius* (S-PA); s.l., *Ule 270* (BM).

The species has also been reported from Brasil by Ångström (1876b).

8 **Isotachis lindigiana** Gottsche, Ann. Sci. Nat. V. **1**: 123. 1864.

Plants of medium to large size, bright red to reddish-brown or green with red-tipped teeth, ascending to erect, in tufts or cushions; stems 4–6 cm long, with leaves to 2 mm wide, irregularly branched; stems in transverse section 12–15 cells across, the cortical cells in two layers, the walls very thick, the cells smaller than those of the medulla. Rhizoids not seen. Leaves imbricate, patent, asymmetric, ovate, bifid to one-third of their length; segments bluntly triangular, the sinus V- or U-shaped, the leaf margin including the sinus uneven, serrulate, rarely dentate with small teeth; cells of the median portion of the lamina averaging 54 × 22 μ, the walls uniformly thin, without trigones; cells of the margin and segments smaller, with thicker walls and trigones, the cuticle smooth to minutely striolate-papillose. Underleaves smaller than the leaves, ovate to orbicular, bifid to one-third of their length, the segments blunt, the margins as in the leaves. Female bracts and bracteoles similar to the leaves and underleaves, larger, the margins of the bracteoles dentate with large, occasionally branched teeth. Perigynium conic-cylindric, 5–6 mm long, arcuate. Male inflorescence and sporophyte not seen. Fig. 8, a–e.

Habitat: On soil.

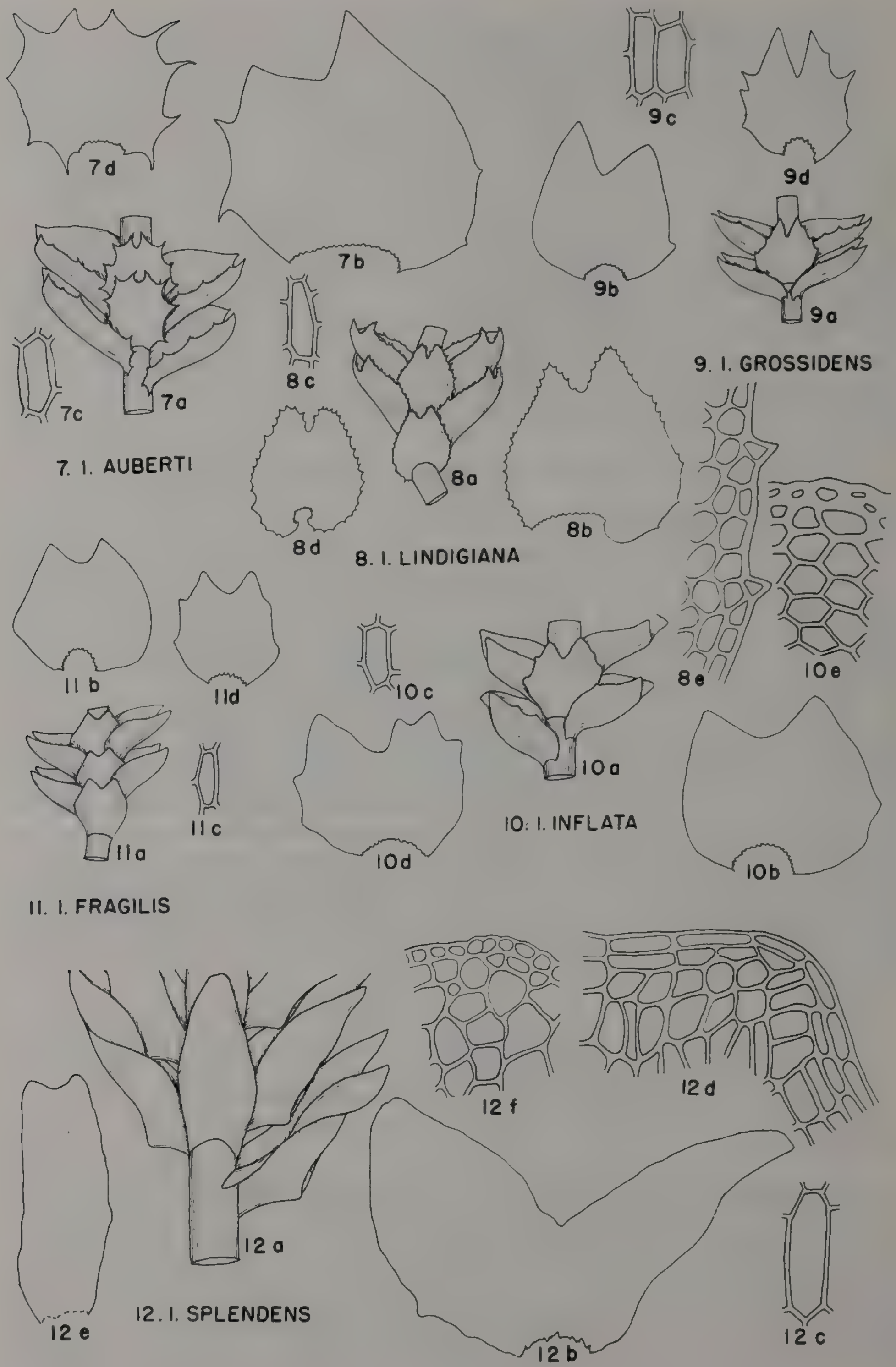
COLOMBIA: Bogotá, *Weir* (NY), *Lindig 1702*, (type, S-PA, isotypes G, BM), *Lindig* (FH), *K. Troll 2063a* (as f. *minor*) (Hb. Herzog).

ECUADOR: Quito, *Jameson* (NY, BM); Pichincha, *Jameson 137* (BM).

BOLIVIA: Yungas, *Rusby 5037* (NY, BM); Nuduar, *Rusby 5038* (NY); Tablas, *Herzog 2783* (S-PA).

9. **Isotachis grossidens** Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 69. *f. 25, f–g.* 1911.

Plants of small to medium size, pale greenish-brown, ascending to erect, in tufts or mats; stems to 3 cm long, with leaves to 2.5 mm wide, irregularly branched; stem in transverse section 8–12 cells in diameter, the unistratose cortical layer of smaller cells than those of the medulla. Rhizoids absent. Leaves widely spreading, concave to canaliculate, ovate, bifid to one-third or one-half of their length ,the sinus V-shaped, the leaf margins entire or with one or a few coarse teeth; cells of the median portion of the lamina averaging 58 × 25 μ, the


7d
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9. I. GROSSIDENS

7. I. AUBERTI

8. I. LINDIGIANA

10. I. INFLATA

11. I. FRAGILIS

12. I. SPLENDENS

walls uniformly thin, cells of the segments and margins smaller, the cuticle minutely striolate-papillose. Underleaves nearly as large as the leaves, oval to orbicular, bifid to one-half of their length, the margins with one to several long, coarse, lateral teeth. Male and female inflorescences and sporophyte not seen. Fig. 9, a–d.

Habitat: On soil.

PATAGONIA—TIERRA DEL FUEGO: Valdivia, *Krause* (S-PA); s.l., *Skottsberg 742*, (type G); s.l., *Skottsberg 736, 737, 741* (G). [The specific localities where Skottsberg collected the material are given by Stephani (1911), but there are no collection numbers with these localities and no data on the packets.]

10. **Isotachis inflata** Stephani, Arq. Mus. Rio de Janeiro **13**: 113. 1903.

Isotachis uleana Stephani, Spec. Hep. 3: 663. 1909

Plants of medium to large size, greenish-brown to dark brown, ascending to erect, in tufts or cushions; stems to 6 cm long, occasionally branched; stems 12–15 cells in diameter, the cortical cells in two layers, smaller and with thicker walls than those of the medulla. Rhizoids not seen. Leaves imbricate, widely spreading, canaliculate, broadly ovate-truncate, bifid to one-third of their length; segments broadly triangular, the apices rounded, the sinus lunulate; leaf margins entire or with an occasional tooth on the ventral side; cells of the median portion of the lamina averaging 60 × 27 μ, the walls uniformly thin, the row of marginal cells larger, their long axes at right angles to that of the leaf, the walls uniformly thickened, trigones very small or absent, the cuticle smooth. Underleaves smaller than the leaves, appressed, imbricate, ovate-truncate to orbicular, bifid to one-third of their length, the segments obtuse, the margins with one to several conspicuous teeth. Male and female inflorescences and sporophyte not seen. Fig. 10, a–e.

Habitat: On soil.

BRAZIL: Rio de Janeiro, *Glaziou 5129*, type of *I. uleana* (type G, isotype NY), *Glaziou 11753* (NY), *Glaziou* (as *I. multiceps*) (S-PA, G), *Glaziou* (as *I. conduplicata*) (BM); Serra do Itatiaia, *Dusén*, (type G, isotype FH); s.l., *Dusén 369* (as *I. mascula*) (G); s.l., *Ule 432* (G).

Fig. 7. *Isotachis auberti.* 7 a. Stem, ventral view, × 9. 7 b. Leaf, × 18. 7 c. Cell from the median portion of a leaf, × 165. 7 d. Underleaf, × 18.

Fig. 8. *I. lindigiana.* 8 a. Stem, ventral view, × 9. 8 b. Leaf, × 18. 8 c. Cell from the lamina of the leaf, × 165. 8 d. Underleaf, × 18. 8 e. Cells from the margin of a leaf, × 165.

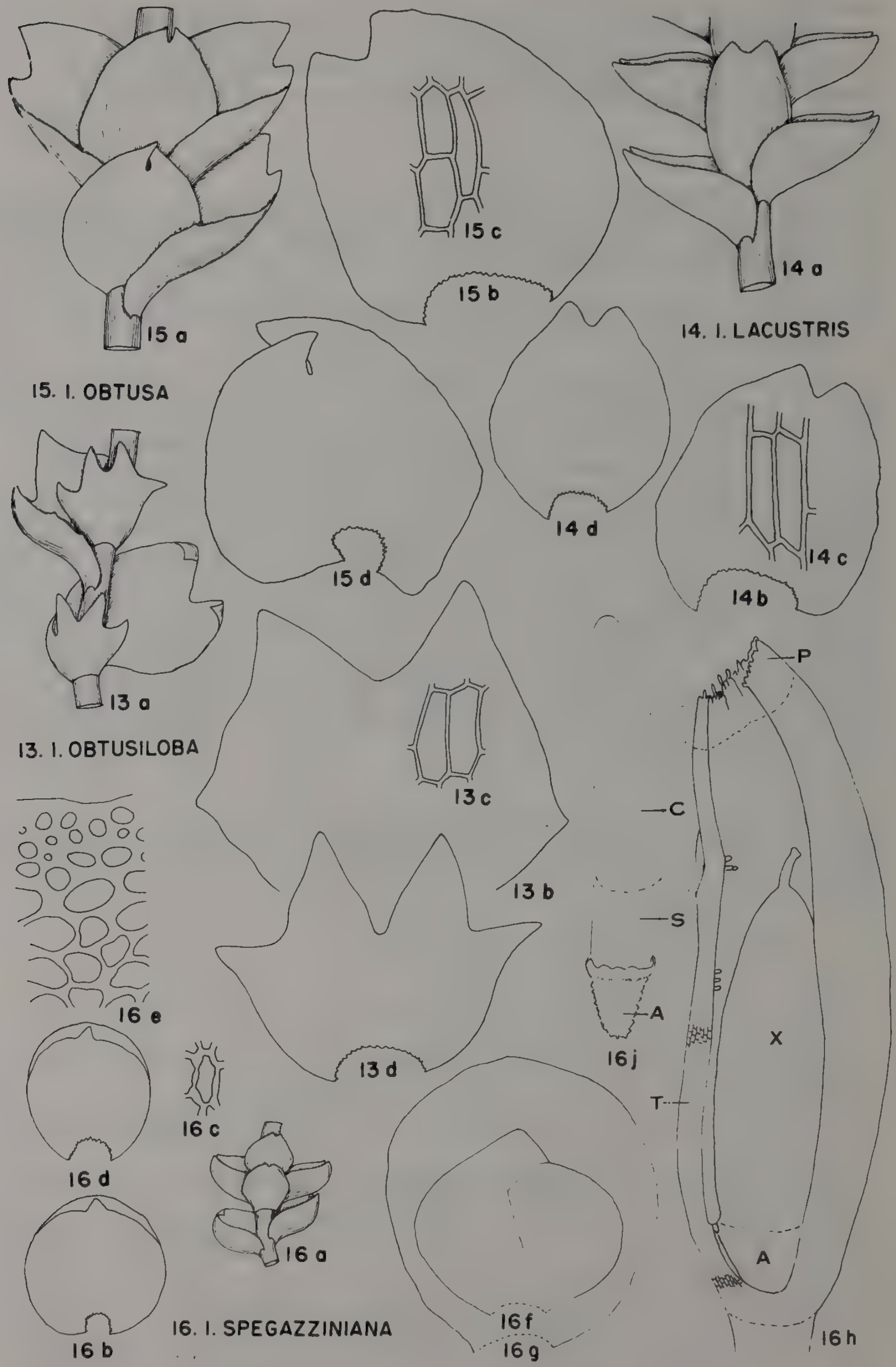
Fig. 9. *I. grossidens.* 9 a. Stem, ventral view, × 9. 9 b. Leaf, × 18. 9 c. Cells from the median portion of the leaf, × 165. 9 d. Underleaf, × 18.

Fig. 10. *I. inflata.* 10 a. Stem, ventral view, × 9. 10 b. Leaf, × 18. 10 c. Cell from the median portion of a leaf, × 165. 10 d. Underleaf, × 18. 10 e. Portion of a transverse section of a stem, × 165.

Fig. 11. *I. fragilis.* 11 a. Stem, ventral view, × 9. 11 b. Leaf, × 18. 11 c. Cell from the median portion of a leaf, × 165. 11 d. Underleaf, × 18.

Fig. 12. *I. splendens.* 12 a. Stem, ventral view, × 9. 12 b. Leaf, × 18. 12 c. Cell from the median portion of a leaf, × 165. 12 d. Cells from the margin of a leaf segment, × 165. 12 e. Underleaf, × 18. 12 f. Portion of a transverse section of a stem, × 165.

Drawn from Hatcher, 1960.


15 c
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15. I. OBTUSA
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14. I. LACUSTRIS
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14 d
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16 j
16 e
16 d
16 c
16 a
16 b
16. I. SPEGAZZINIANA
16 f
16 g
A
16 h

11. **Isotachis fragilis** Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 67. *f.* 25, *b*, *c*. 1911.

Plants of small to medium size, dark brown to brownish-green, ascending to erect, in tufts or cushions; stems 2–3 cm long, with leaves to 1.7 mm wide, often branched, the branches near the base of the stem; stems in transverse section 12–14 cells in diameter, the cortical band of two layers of cells with very thick-walls, the cells of the medulla larger, with thinner walls. Rhizoids not seen. Leaves imbricate, widely spreading, canaliculate, broadly ovate-truncate to orbicular, bifid to one-fourth of their length; segments erect, obtuse, the sinus broad, rounded; leaf margins entire or with an occasional tooth at about the middle; cells of the median portion of the lamina averaging 47 × 16 μ, the walls uniformly thin, trigones inconspicuous or absent, the cells of the margin and the segments smaller, the cuticle smooth. Underleaves nearly as large as the leaves, similar, orbicular, with one or two lateral teeth. Male and female inflorescences and sporophytes not seen. Fig. 11, a–d.

Habitat: Not given.

PATAGONIA—TIERRA DEL FUEGO: s.l., *Skottsberg 886*, (type G). [Stephani (1911) has listed two localities, Isla Atalaya and Tal n. von Lago Fagnano, but does not cite collection numbers with these localities; the packet containing the type material does not give locality.]

12. **Isotachis splendens** Stephani, Hedwigia **34**: 49. 1895.

Plants large, bright red to magenta, prostrate to ascending, in mats or cushions; stems 5–10 cm long, with leaves 3–4 mm wide, sparingly branched; stem in transverse section 12–15 cells in diameter, the cortex of one or two layers of smaller cells with slightly thicker walls than the large cells of the medulla. Rhizoids not seen. Leaves flaccid, erect-spreading, canaliculate, bifid to two-thirds or four-fifths; segments long, narrowly ovate-truncate to ligulate, divergent, the sinus very broad; leaf margins entire with one or two obscure or poorly defined teeth; cells of the median portion of the leaf averaging 108 × 35 μ, the walls thin, the trigones very small or absent, the cells of the marginal one or two rows long, narrow, forming a conspicuous border, the cuticle smooth. Underleaves as long as the leaves, ligulate to narrowly ovate, bidentate or retuse. Male and female inflorescences and sporophyte not seen. Fig. 12, a–f.

Habitat: Not given.

PATAGONIA—TIERRA DEL FUEGO: Straits of Magellan, Tuesday Bay, *Cunningham 159*, (type G, isotype FH); Desolation I., *Dusén* (G).

FIG. 13. *Isotachis obtusiloba.* 13 a. Stem, ventral view, × 9. 13 b. Leaf, × 18. 13 c. Cells from the median portion of a leaf, × 165. 13 d. Underleaf, × 18.

FIG. 14. *I. lacustris.* 14 a. Stem, ventral view, × 9. 14 b. Leaf, × 18. 14 c. Cells from the median portion of a leaf, × 165. 14 d. Underleaf, × 18.

FIG. 15. *I. obtusa.* 15 a. Stem, ventral view, × 9. 15 b. Leaf, × 18. 15 c. Cells from the median portion of a leaf, × 165. 15 d. Underleaf, × 18.

FIG. 16. *I. spegazziniana.* 16 a. Stem, ventral view, × 9. 16 b. Leaf, × 18. 16 c. Cells from the median portion of a leaf, × 165. 16 d. Underleaf, × 18. 16 e. Portion of a transverse section of a stem, × 165. 16 f. Female bract of the outer series, × 25. 16 g. Female bract of the innermost series, × 25. 16 h. Section through a perigynium, × 25; X, sporophyte; A, foot of the sporophyte; H, hyaline portion, the perianth; T, the thick wall. 16 j. Young sporophyte, × 25; A, foot with a covering tissue; S, seta; C, capsule.

Drawn from Hatcher, 1960, except 16 f–j.

13. Isotachis obtusiloba Herzog, Beih. Bot. Centr. **60** (B): 11. *f. 4.* 1939.

Isotachis mollissima Herzog, Revue Bryol. Lichénol. 23: 51. *f. 10, a–d.* 1954

Plants of small to medium size, pale green, flaccid; stems slender, 3–5 cm long, with leaves 2.5–3.5 mm wide, simple or irregularly branched; stems in transverse section 16–18 cells in diameter, the unistratose cortical layer of smaller, thick-walled cells. Rhizoids in tufts on the bases of the underleaves. Leaves approximate, patent, broadly ovate-truncate to subquadrate, bifid to one-half of their length or less; segments broad, triangular, divergent, the sinus broad, V-shaped; leaf margins entire or with one tooth midway or below on both sides; cells of the median portion of the leaf averaging 73 × 33 μ, the walls thin, without trigones, the cells of the margin and segments smaller, the cuticle smooth to minutely striolate. Underleaves distant to approximate, broad, bifid to one-half of their length, the margins with a large lateral tooth similar to a segment on each side, rarely with additional smaller teeth. Male and female inflorescences and sporophyte not seen. Fig. 13, a–d.

Habitat: In water.

CHILE: Calbuco, *Schwabe 155,* (type Hb. Herzog); Pto. Magdalena I., *Schwabe 20 b2,* type of *I. mollissima* (Hb. Herzog).

14. Isotachis lacustris Herzog, Hedwigia 74: 94. 1934.

Plants of medium size, dark purple-brown, ascending to erect in tufts; stems stout, 4–5 cm long, the leaves 3–4 mm wide, occasionally branched; stems in transverse section 14–16 cells across, the cortical cells in one or two layers, very thick-walled, the cells of the medulla larger, with thinner walls. Rhizoids not seen. Leaves widely spreading, canaliculate, broadly ovate to orbicular, bifid to one-sixth of their length; segments short, triangular, rounded at the apex, the sinus V-shaped; leaf margins entire; cells of the median portion of the leaf averaging 100 × 22 μ, the walls thin, without trigones, cells of the segments smaller, thick-walled, the lumina angular-rounded, the cuticle smooth. Underleaves only slightly smaller than the leaves, similar. Male and female inflorescences and sporophyte not seen. Fig. 14, a–d.

Habitat: Growing in water.

BOLIVIA: Illampu Peak, Mt. Sorata, Cordillera Real, *C. Troll 56* (type Hb. Herzog).

15. Isotachis obtusa Stephani, Spec. Hep. **6**: 354. 1924.

Plants of medium to large size, dark reddish-brown, ascending to erect; stems 5–7 cm long, to 4 mm wide, occasionally branched; stems in transverse section 16–18 cells across, the cortical cells in one or two layers, smaller than those of the medulla, thin-walled. Rhizoids not seen. Leaves erect-spreading to patent, very broadly ovate to orbicular, asymmetric, bifid to one-sixth of their length or less; segments short, blunt, triangular, divergent, the sinus V-shaped; margins of the leaves entire; cells of the median portion of the lamina averaging 84 × 40 μ, the walls thin, without trigones, the cells of the segments subquadrate, the cuticle smooth. Underleaves only slightly smaller than the leaves, orbicular, bifid, the segments acute, connivent, the margins entire. Male and female inflorescences and sporophyte not seen. Fig. 15, a–d.

Habitat: In water.

ECUADOR: Azuay: Páramo, Mt. Matanga, *Allioni 6568* (type G).

16. Isotachis spegazziniana Massalongo, Nuovo Gior. Bot. Ital. **17**: 220. *pl. 16, f. x.* 1885.

Plants of small to medium size, dark brown, ascending to erect, in tufts; stems 4–6 cm long, with leaves to 1.5 mm wide, occasionally branched; stems in transverse section 12–15 cells in diameter, the cells of the cortical band in one or two rows, smaller, with thicker walls than those of the medulla. Rhizoids not seen. Leaves spreading, subimbricate, orbicular, often cucullate, notched for one-sixth of their length or less, the sinus small, V-shaped; cells of the median portion averaging 36 × 17 μ, the walls thickened, the intermediate thickenings and trigones conspicuous, the cuticle smooth. Underleaves scarcely distinguishable from the leaves. Female inflorescence terminal on the stem, the bracts and bracteoles similar to the leaves and underleaves, larger, the bracts of the innermost series undivided. Perigynium 4–5 mm long, arcuate, the mouth short-ciliate, hyaline, the wall four to six layers of cells thick below, the outermost layer often hyaline, the inner wall with occasional papillae. Sporophyte (very young) enclosed in a shoot-calyptra with scattered unfertilized archegonia on the surface, the foot enclosed in a thin covering, the capsule long-cylindric. Male inflorescence not seen. Fig. 16, a–j.

Habitat: In water and on soil in wet areas.

PATAGONIA—TIERRA DEL FUEGO: Desolation I., Puerto Angosta, *Dusén 138, 184, 388, 587* (G); Río Azopardo, *Dusén 97* (G); Basket I., Desolation Bay, *Spegazzini 195* (type VER).

The following taxa now in the genus *Isotachis* have not been included in the present study, either because the types were not available or because the material was not conclusive. All need further study.

Isotachis allionii Stephani, Ecuador.
Isotachis boliviensis Gottsche ms.
Isotachis dentata Stephani ms., Icones Hep. *Isotachis* No. 52. Patagonia.
Isotachis fuegiensis Stephani, Patagonia.
Isotachis granditexta Stephani, Patagonia.
Isotachis hians Stephani, Bolivia.
Isotachia homophylla (Nees) Stephani, Brazil.
Isotachis mascula Gottsche, Colombia.
Isotachis quadriloba Stephani, Patagonia.
Isotachis stubelii Stephani ms., Icones Hep., *Isotachis* No. 29, Colombia.
Isotachis valida Stephani, Patagonia.
Isotachis vexans Stephani, Venezuela.

There have been a number of additional subspecific taxa described by various authors at various times.

PACHYGLOSSACEAE Fulford, fam. nov.

Lophocoleaceae Herzog & Grolle, Revue Bryol. Lichénol. 27:162. 1959.

Caules foliosi erecti, radiales, ramis basilaribus stolonoideis, fusci; ramis foliosis flagelliformibusve in axillis foliorum amphigastriorumque. Folia amphigastriaque transversa, ex ovatis ad breviter rigida, pluristratosa omnino (in specie unica ad medium). Inflorescentia masculina terminalis tum intercalaris; inflorescentia feminea terminalis, innovationibus subfloralibus praesentibus vel absentibus; bracteis bracteolisque foliis similibus, pluristratosis. Perianthium supra 3–5-carinatum.

Leafy stems erect, with stolon-like branches at the base, radially symmetric; branches leafy, more rarely flagelliform, axillary from the leaves and underleaves. Rhizoids from the scale leaves of the flagelliform branches. Line of leaf insertion transverse, the ends slightly decurved. Leaves and underleaves scarcely different, pluristratose throughout or in the lower half. Male inflorescence terminal becoming intercalary on the stem or leafy branch. Female inflorescence terminal on the stem or branch, with or without subfloral innovations, the bracts and bracteoles like the leaves and underleaves, larger, pluristratose. Perianth three-lobed or divided above, 3–5-keeled, unistratose. Sporophyte not seen.

Type genus: *Pachyglossa* Herzog & Grolle.

The family is monogeneric; the distribution is Antarctic.

Pachyglossa, Herzog & Grolle, Revue Bryol. Lichénol. **27**: 150. 1958.

Pachyglossa Herzog, Rev. Bryol. Lichénol. 21: 256. 1952. (nomen nudum.)

Plants of small to medium size, erect, with stolon-like branches at the base, radially symmetric, greenish-brown to dark brown, in tufts or among other bryophytes. Rhizoids from the scale-like leaves of the flagelliform branches and the rhizome. Line of leaf insertion transverse, the ends slightly decurved. Leaves and underleaves ligulate to ovate, the apex blunt, retuse or very shortly bifid, pluristratose throughout (in one species only to the middle). Plants dioicous. Male inflorescence terminal, becoming intercalary on the stem or leafy branch, the bracts and bracteoles in few series, similar, like the leaves and underleaves, larger, in some with a large marginal tooth; antheridia in the axils of the bracts, the stalk uniseriate. Female inflorescence terminal on the stem or a leafy branch, without or with one or more innovations, the bracts and bracteoles in two or three series, similar to the leaves and underleaves, larger, of two or three layers of cells; archegonia less than 20. Perianth 3-keeled, deeply 3-parted above, or 4- or 5-plicate with the mouth 3-lobed. Sporophyte not seen.

Type species, *Jungermannia tenacifolia* Hooker f. & T. Taylor.

KEY TO THE SPECIES

1. Leaves of two to several layers throughout; superficial leaf-cells 15–20 × 13–35 μ.

  2. Leaves ligulate to ovate, obtuse, entire, retuse or very shortly bifid.

    3. Leaf cells uniformly thick-walled; stems in transverse section with several layers of very thick-walled cortical cells. (not seen in S. America) 1. *P. tenacifolia.*

    3. Leaf-cells with thin walls and small trigones; stem in transverse section with only one layer of thickened cortical cells. 2. *P. dissitifolia.*

  2. Leaves broadly ovate, obtuse and shortly bifid; perianth 4–5-plicate, the mouth irregularly dentate and short-ciliate. 3. *P. fissa.*

1. Leaves of two layers of cells only in the lower part, the upper part unistratose; leaf-cells 10–16 × 10–20 μ; leaves obovate, undivided. 4. *P. spegazziniana.*

1. Pachyglossa tenacifolia (Hooker f. & Taylor) Herzog & Grolle, Revue Bryol. Lichénol. **27**: 153. *f. 1–10.* 1958.

Jungermania tenacifolia Hooker f. & Taylor in J. D. Hooker, Bot. Antarct. Voy. 1^1: 152. *pl. 64, f. 6.* 1845.

Mastigobryum tenacifolium (Hooker f. & Taylor) Mitten in J. D. Hooker, Bot. Antarct. Voy. 2^2: 147. 1853.

Herpocladium tenacifolium (Hooker f. & Taylor) Mitten, Jour. Linn. Soc. Bot. 15: 69. 1877.

Bazzania ? tenacifolia (Hooker f. & Taylor) Massalongo, Nuovo Gior. Bot. Ital. 17: 243. 1885.

Pachyglossa tristicha Herzog ex Martin, Trans. Proc. Roy. Soc. N. Zeal. 78: 500. 1950 (nomen nudum); Revue Bryol. Lichénol. 21: 256. *f. 1, a–d.* 1952.

Plants of medium size, erect, with stolon-like branches from the base, radially symmetric, dark brown, in tufts or among other bryophytes; stems rigid, 3–5 cm long, with leaves 1 mm wide, sparingly irregularly branched; branches in the axils of both leaves and underleaves, long, leafy or flagelliform with scale-like leaves; stem in transverse section brown, with a cortical band of three layers of cells with very thick walls. Rhizoids in groups from near the bases of the scale-leaves of the flagelliform branches. Leaves erect-spreading, ligulate, obtuse or scarcely emarginate, mostly 1 mm long, 0.35–0.4 mm wide, the margin entire, pluristratose, of two layers of cells at the middle and above, of more layers below: leaf-cells in surface view quadrate, the wall uniformly thickened. Underleaves similar, scarcely distinguishable. Plants dioicous. Female inflorescence terminal on the stem or a long branch, the bracts and bracteoles in two or three series, similar, like the leaves and underleaves, larger, pluristratose; archegonia ten to fifteen. Perianth (immature) three-keeled, divided into three long lobes above, with undulate to obscurely toothed margins. Sporophyte not seen. Fig. 1, a–c.

Habitat: On soil in exposed places.

The species has been collected on the Auckland Islands and Stewart Island, and has been reported in the literature from South America by Massalongo (1885, coll. Spegazzini) and Stephani (1911, coll. Skottsberg). The latter collections belong to the next species which is very similar. I have seen no specimens from South America.

2. Pachyglossa dissitifolia Herzog & Grolle, Revue Bryol. Lichénol, **27**: 155. *f. 2, 3.* 1958.

Pachyglossa dissitifolia Herzog, Revue Bryol. Lichénol. 21: 259. *f.* 1952. (nomen nudum.)

Plants of small to medium size, erect, with stolon-like branches from the base, radially symmetric or nearly so, flaccid, in tufts or among other bryophytes; stems slender, to 5 cm long, with leaves to 1 mm wide, occasionally branched; branches axillary from the leaves and underleaves, leafy or flagelliform; stems in transverse section with a unistratose cortical layer of many cells, some smaller than those of the medulla, the walls scarcely thickened. Leaves ligulate or narrowly ovate, obtuse, patent, pluristratose throughout, the margins entire; leaf-cells in surface view 15–25 × 15 × 35 μ, the walls uniformly thickened, the trigones minute, the cuticle verruculose. Underleaves similar, scarcely smaller, occasionally very shortly bifid. Plants dioicous. Male inflorescence terminal, becoming intercalary on the stem or leafy branch, the bracts and bracteoles in few pairs, similar to the leaves and underleaves; antheridia solitary or in pairs. Female inflorescence terminal on the stem or a branch, with subfloral innovations, the bracts and bracteoles in two or three series, similar, like the leaves and underleaves, larger. Perianth trigonous, divided into three long lobes above, the margins undulate to obscurely toothed. Sporophyte not seen. Fig. 2, a–d.

Habitat: On soil.

PATAGONIA—TIERRA DEL FUEGO: Cerro Tesoro Massiv, 1000 m, *G. H. Schwabe*, (type Hb. Herzog); Nahuel Haupí, 1500 m, *Wolffügel* (Hb. Herzog); Ushuaia, 780 m, *Skottsberg* [1902] (S-PA); Río Azapardo; 600 m, *Dusén* (UPS, S-PA); Sierra Valdiviesci, 750 m, *Skottsberg* (S-PA); Lago Fagnano, *Halle* (S-PA); Staten I., Port Cook, *Skottsberg* (S-PA). [I have cited the localities as given by Herzog & Grolle, 1959.] The species also occurs in Tristan da Cunha, crater of the Peak, 2000 m, *Christopherson & Mejland* (as f. *minima*) (Herzog & Grolle, 1958).

3. **Pachyglossa spegazziniana** (Massalongo) Herzog & Grolle, Revue Bryol. Lichénol. **27**: 159. *f. 4, 5.* 1958.

Lophocolea spegazziniana Massalongo, Nuovo Gior. Bot. Ital. **17**: 225. *pl. 17, f. 13.* 1885.
Lophocolea spegazzinii (Massalongo) Stephani, Spec. Hep. **3**: 54. 1906.
Lophocolea azopardana Stephani, Spec. Hep. **3**: 54. 1906.
Herpocladium minimum Stephani ms., Icones Hepat., *Herpocladium*, no. 4.
Pachyglossa speggaziniana var. *exilis* Herzog & Grolle, Revue Bryol. Lichénol. **27**: 159. *f. 6.* 1958.

Plants of small to medium size, prostrate to ascending with stolon-like branches from the base, yellow-green to brown, in mats; stems rigid, 2–8 cm long, irregularly branched, the branches in the axils of the leaves and underleaves; stems in transverse section with a unistratose cortical layer of somewhat smaller cells with thickened walls. Rhizoids on the scale leaves of the basal stolons and the flagelliform branches. Leaves distant to approximate or imbricate, broadly obovate to elliptic, the apex rounded or obtuse, rarely recurved above, patent, to 1 mm long, the margin entire, pluristratose to the middle (rarely only at the base); cells of the upper portion of the leaf 10–16 × 10–20 μ, the walls uniformly thin, the trigones small, distinct, the cuticle verruculose. Underleaves similar to and as large as the leaves, smaller than the leaves on robust stems, of equal size, ligulate to narrowly ovate, obtuse, emarginate to very shortly bidentate at the tip. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts and bracteoles similar to the leaves and underleaves, in few series; antheridia solitary, in the axils of the bracts. Female inflorescence terminal on the stem or a leafy branch, often with one or two subfloral innovations, the bracts and bracteoles similar to the leaves

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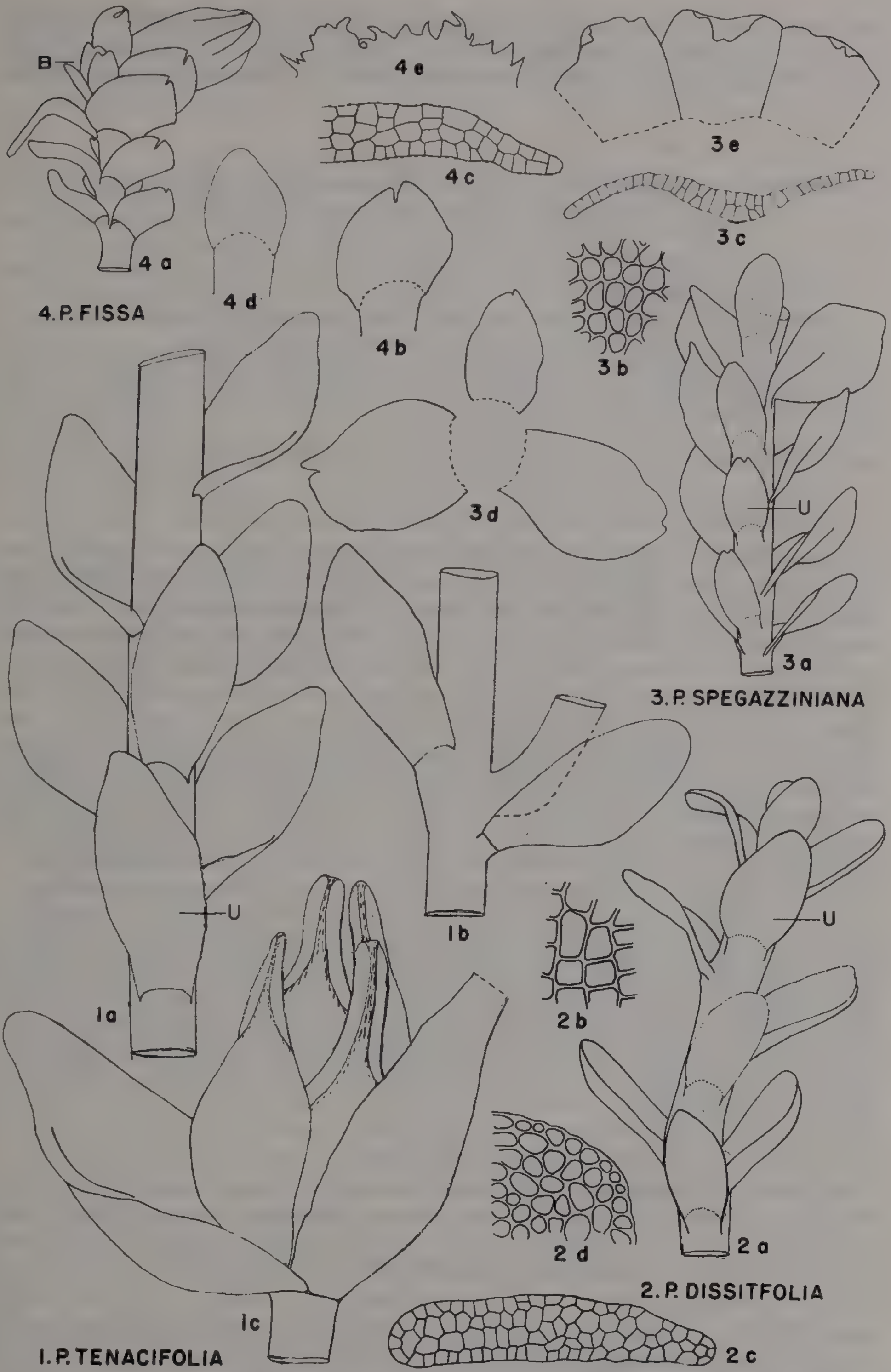
FIG. 1. *Pachyglossa tenacifolia.* 1 a. Portion of a stem, ventral view, × 30; U, underleaf. 1 b. Stem, dorsal view, showing an axillary lateral branch, × 33. 1 c. Young female inflorescence with bracts and bracteoles, × 33.

FIG. 2. *P. dissitifolia.* 2 a. Portion of a stem, ventral view, × 18; U, underleaf. 2 b. Leaf cells, surface view, × 200. 2 c. Transverse section of a leaf, × 83. 2 d. Portion of a transverse section of a stem, × 160.

FIG. 3. *P. spegazziniana.* 3 a. Portion of a stem, ventral view, × 18. 3 b. Leaf cells, × 200. 3 c. Transverse section through the leaf below the middle, × 83. 3 d. Female bracts and the bracteole of one series, × 18. 3 e. Perianth, opened out, × 18.

FIG. 4. *P. fissa.* 4 a. Stem with a perianth and a subfloral innovation, × 18; B, the innovation. 4 b. Leaf, × 36. 4 c. Transverse section through a leaf, × 200. 4 d. Underleaf, × 36. 4 e. Mouth of the perianth, × 36.

FIGS. 2, 3, and 4 after Herzog & Grolle, 1958, Grolle, 1959.


B
4 e
3 e
4 c
3 c
4 a
4 d
4. P. FISSA
4 b
3 b
U
3 d
3 a
3. P. SPEGAZZINIANA
U
1 b
U
2 b
1 a
2 d
2 a
2. P. DISSITFOLIA
1 c
2 c
1. P. TENACIFOLIA

and underleaves, larger, in several series, the inner series often shortly bidentate at the tips. Perianth 3-keeled, distinctly 3-lobed above, the margin of each broad lobe undulate, often with obscure teeth, the tip often shortly bifid. Sporophyte not seen. Fig. 3, a–e.

Habitat: On soil.

PATAGONIA—TIERRA DEL FUEGO: Río Azopardo, 600 m, *Dusén* (G; S-PA); n of Cerro Tronador, 1400–1700 m, *Schiller* (Hb. Herzog); Río Azopardo, 720 m, *Halle & Skottsberg* (UPS); Vulcán Calbuco, 1000 m, *Schiller* (Hb. Herzog); Cerro Tesoro Massiv, 1000 m, *G. H. Schwabe* (Hb. Herzog); Staten I.: Port Cook, *Skottsberg* (S-PA).

FALKLAND ISLANDS: Mt. Adams, 700 m, *Halle & Skottsberg*, type of *H. minimum* (type G, isotype S-PA).

TRISTAN DA CUNHA: The Peak, 2000 m, *Christopherson & Mejland* (S-PA).

[The above list of stations is taken from Herzog & Grolle, 1958.]

The species has also been reported (under various synonyms) from the area in the following literature: Gola (1923), Herzog (1954), Kühnemann (1949), Massalongo (1885, 1927), and Stephani (1901a, 1911).

4. **Pachyglossa fissa** (Mitten) Grolle, Revue Bryol. Lichénol. **28**: 346. *f. a–n.* 1959.

Herpocladium fissum Mitten, Jour. Linn. Soc. Bot. 15: 69. 1877.

Plants small, reddish-brown, tending to be radially symmetric, among other bryophytes; stems rigid, to 2 cm long, sparingly branched, the branches in the axils of the leaves and underleaves; stems in transverse section with a cortical band of one or two layers of cells, smaller, with thicker walls than the cells of the medulla. Rhizoids on the scale-like leaves of the flagelliform branches. Line of leaf insertion transverse or slightly convex, the ends decurved on both sides. Leaves spreading, obovate from a narrow base, 0.4–0.5 mm long, bifid to one-sixth of their length or less, the segments straight, the sinus narrow, the margins entire, sometimes with an obscure tooth near the apex, pluristratose, the apex and margins of two layers of cells, the rest of the leaf of three or more layers, the lamina with scattered superficial cilia of one to four cells, near the dorsal base; cells in surface view 15–20 × 15–25 μ, the walls uniformly thickened, the trigones small, distinct, the cuticle striolate. Underleaves similar to the leaves, slightly smaller, acute to obtuse. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts and bracteoles in few series, like the leaves and underleaves, larger, bifid above, the lateral tooth more conspicuous; antheridia in pairs in the axils of the bracts. Female inflorescence terminal, with subfloral innovations, the bracts and bracteoles in two series, like the leaves and underleaves, larger. Perianth cylindric, contracted and 4–5 plicate above, the mouth with obscure lobes (?), the margin ciliate-dentate. Fig. 4, a–e.

Habitat: On soil among other bryophytes.

PATAGONIA—TIERRA DEL FUEGO: Desolation I., 600 m, *Dusén* (S-PA); Cerro Tesoro Massiv, 1200 m, *G Schwabe 38d* (Hb. Herzog); Río Azopardo, 700 m, *Halle & Skottsberg* (S-PA).

KERGUELEN I: s.l., *Moseley*, Challenger Exped., (type NY), *Moseley* (NY).

References

Herzog, T. 1950. *Pachyglossa.* In W. Martin, The Bryophytes of Stewart Island II. Trans. Roy. Soc. N. Zeal. **78**: 4.

Herzog, T. 1952 Drei neue Lebermoose aus Westpatagonien. Revue Bryol. Lichénol. **21**: 256–261. *f. 1–3.*

Herzog, T. & Grolle, R. 1958. Was ist *Pachyglossa*? Revue Bryol. Lichénol. 27: 147–165. *f. 1–5.*

Hattori, S. & Mizutani, M. 1958. *Pachyglossa tristicha* Herz. and its relationships. Jour. Jap. Bot. 33: 359–363. *f. 1, 2.*

HERBERTACEAE K. Müller in Rabenhorst, Krypt.-Fl. **6**: 557. 1954. emend. Fulford & Hatcher, Bryologist **61**: 284. 1958.

Ptilidiaceae auctt. p.p.

Leafy stems erect or pendent, tending to be radially symmetric, brown, irregularly branched (in *Herberta* the stems arising from a creeping caudex with scale-like leaves); branches both terminal (*Frullania* type) and intercalary in orgin, the intercalary branches ventral, axillary, or on the stem at the ventral side of the leaf. Line of leaf insertion transverse, or oblique with the leaves incubous. Leaves bifid or trifid, with lanceolate divisions. Underleaves like the leaves, rarely much smaller. Male inflorescence terminal but becoming intercalary on the stem or branch, radially symmetric; antheridia in the axils of both the bracts and the bracteoles, the stalk of two rows of cells. Female inflorescence terminal on the stem or a leafy branch, without or with one or two innovations, the bracts and bracteoles essentially like the leaves and underleaves. Perianth long, contracted above, three- to six-plicate, divided to one-fourth or more into six to nine entire or toothed segments.

Type genus: *Herberta* S. F. Gray.

Key to the Genera

Leaves and underleaves with a well-marked vitta of elongate cells; leaf-cells thick-walled, with large, knot-like trigones and intermediate thickenings. 2. *Herberta.*

Leaves and underleaves without a vitta; leaf-cells quadrate to hexagonal in outline, thin-walled, without trigones. 1. *Triandrophyllum.*

Triandrophyllum Fulford & Hatcher, Bryologist **64**: 349. 1961 [1962].

Isotachis auctt. p.p.

Plants large or small, ascending to erect, simple or irregularly branched. Lateral branches of the *Frullania* type with the half-leaf at the dorsal base, leafy, ventral branches frequent, intercarlary, from the axils of the underleaves, leafy or flagelliform; stem in transverse section 12–16 cells in diameter, the cells of the cortex in one or two layers, small, thick-walled, those of the medulla large with thinner walls. Line of leaf insertion oblique, recurved at the dorsal end, the leaves incubous. Rhizoids not seen. Leaves asymmetric, bifid or trifid to one-fifth or one-half of their length; segments acute, triangular, the margins dentate or spinose or entire; leaf-cells small, round-quadrate to hexagonal, thin-walled, the trigones minute or absent, the cuticle smooth to verruculose-papillose. Underleaves as large as the leaves, similar, or smaller with the margins abundantly toothed. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or the branch, the bracts and bracteoles in eight or more series, similar to the leaves and underleaves, larger, concave; antheridia large, globose, two or three in the axils of both the bracts and the bracteoles, the stalk of two or more rows of cells. Female inflorescence terminal on the stem or a branch, the bracts and bracteoles in two or three series, similar to the leaves and underleaves, slightly larger and with more marginal teeth. Perianth oblong, with three to five folds or keels above, the mouth contracted, divided into six to nine triangular segments. Capsule ovoid, dark red-brown, the wall of four or five layers, the outermost layer of large cells with dark thickening bands, the inner layers of smaller cells with both radial and tangenital thickenings. Elaters long, tapering, bispiral to the tips.

Type species: *Jungermannia subtrifida* J. D. Hooker & T. Taylor.

1. **Triandrophyllum subtrifidum** (J. D. Hooker & T. Taylor) Fulford & Hatcher, Bryologist **64**: 350. 1961 [1962].

Jungermannia subtrifida J. D. Hooker & T. Taylor, London Jour. Bot. 3: 579. 1844.
Isotachis subtrifida (Hooker & Taylor) Mitten, in J. D. Hooker, Bot. Antarct. Voy. 2^2: 148. 1855.
Isotachis ripensis Spruce, Trans. Proc. Bot. Soc. Edinb. 15: 339. 1885.
Isotachis anceps Massalongo, Nuovo Gior. Bot. Ital. 17: 219. *pl. 15, f. 9.* 1885.
Isotachis nordenskjöldii Stephani, Spec. Hep. 3: 659. 1909.
Isotachis halleana Stephani, Sv. Vet.-akad. Handl. 46^9: 69. *f. 27 a, b.* 1911.
Isotachis lanciloba Stephani, Sv. Vet.-akad. Handl. 46^9: 70. *f. 26 f–g.* 1911.
Isotachis heterophylla Stephani, Spec. Hep. 6: 354. 1924.
Isotachis mutabilis Herzog in Herzog & Hosseus, Arch. Escuel. Farm. Fac. Ci. Méd. Córdoba 7: 26. 1938.
Isotachis ripensis var. *armata* Herzog, Revue Bryol. Lichénol. 11: 24. 1938 [1939].

Plants of medium to large size, brown, ascending to erect, in tufts or cushions; stems to 6 cm long, with leaves to 3 mm wide, irregularly branched; lateral branches leafy, occasional, ventral branches intercalary, more frequent, leafy or flagelliform; stems in transverse section 12 to 16 cells in diameter, the cells of the cortical band in one or two rows, small, thick-walled, those of the medulla large, with thinner walls. Line of leaf insertion oblique and decurved at the dorsal end, the leaves incubous. Leaves approximate to imbricate, spreading, tending to be deflexed, asymmetric, 1–2 mm long, 0.9–1.5 mm wide, ovate to ovate-truncate, the margins entire, bifid or trifid to one-half of their length; segments lanceolate or broader, acute to blunt; leaf-cells at the base of the segments quadrate to hexagonal in outline, 27–36 × 27–30 μ, thin-walled, the trigones minute or absent, the cuticle smooth to verruculose. Underleaves symmetric, as large as the leaves or scarcely smaller. Plants diocious. Male inflorescence terminal becoming intercalary on the stem or a branch, the bracts and bracteoles in eight or more series, similar to the leaves and underleaves, the margins often with more teeth; antheridia two or three in the axils of both bracts and bracteoles. Female inflorescence terminal on the stem or branch, without or with one or two subfloral innovations, the bracts and bracteoles like the leaves and underleaves, slightly larger, the lateral margins with a few teeth. Perianth 2–3.5 cm long, fusiform, divided to one-fourth of its length into six to nine entire, lanceolate lacineae. Sporophyte capsule red-brown, the wall of five layers of cells, in surface view, the outer layer with knot-like thickenings in rows along the radial walls; elaters long, tapering, bispiral; spores red-brown, averaging 20 μ, smooth to faintly verruculose. Fig. 1, a–g.

Habitat: Over soil and rocks in moise shaded areas in open meadows, banks, etc.

GUATEMALA: San Marcos: Volcán Tacaná, *Steyermark 36008, 36451* (F).

COSTA RICA: Volcán Tuirealla, 2000–2400 m, *Standley 35279* (as *I. ripensis* var. *armata*) (isotype, US); San José, Las Nubes, 1500–1900 m, *Standley 38361* (US).

COLOMBIA: Huila-Cauca: Páramo de Las Papas, *Bischler 842, 846, 848* (COL); Cauca: Páramo de Las Papas, *Bischler 900* (♀), *903* p.p. (COL).

ECUADOR: Quito, *Jameson 240* (BM); Andes Quitenses, Pichincha, *Spruce*, type of *I. ripensis* (isotypes FH, G, NY), *Jameson 1850, 1856* (as *J. complicata*, ♀) (G).

PERU: Cuzco: *Vargas 7302* (F).

BOLIVIA: Unduavi, *Brooke 6723, 6875* (♀), *6949* (♂) (BM); s.l., *Herzog*, type of *I. heterophylla* (G).

PATAGONIA-TIERRA DEL FUEGO: Volcán Villarrica, *Hosseus*, type of *I. mutabilis* (G); s.l., *Nordenskjöld 905* p.p., type of *I. nordenskjöldii* (isotype, FH); Fuegia, *Halle*, type of *I. halleana* (G); Patagonia occid., *Skottsberg* (as *I. halleana*) (G); Basket I.: Desolation Bay, *Spegazzini*, type of *I. anceps* (G).

The species also occurs in the Falkland Islands, collected by Skottsberg (type of *I. lanciloba*) (G) and Tristan da Cunha (Arnell, 1958). The species was first collected in Tasmania (type K, isotype G) and also occurs in New Zealand.

There are additional reports of the species from American localities in the literature: Costa Rica (Herzog, 1938a), Argentina (Kühnemann, 1949); Patagonia—Tierra del Fuego (Arnell, 1955; Gola, 1923; Herzog, 1954; Massalongo, 1927; K. Müller, 1955; Stephani, 1900 a, b; 1901a; 1911).

2. **Triandrophyllum trifidum** (Gottsche) Fulford & Hatcher, Bryologist **64**: 348. 1961 [1962].

? Sendtnera trifida Gottsche, Ann. Sci. Nat. V. **1**: 142. 1864.
Herberta dura Stephani, Hedwigia **34**: 44. 1895.
Mastigophora antarctica Stephani, Bihang Sv. Vet.-akad. Handl. III. **26**^{6}: 56. 1900.
Isotachis appendiculata Stephani, Spec. Hep. **3**: 659. 1909.
Isotachis trifida (Gottsche) Stephani, Spec. Hep. **3**: 670. 1909 [incorrectly cited as (Gottsche) Spruce]. Non *I. trifida* Stephani, Spec. Hep. **6**: 356. 1922 [*I. sprucei* Beauverd, in Stephani, Spec. Hep. **6**: 572. 1924].
Schisma dura (Stephani) Stephani, Spec. Hep. **4**: 21. 1909.
Mastigophora trifida (Gottsche) Stephani, Spec. Hep. **4**: 37. 1909.
Lepicolea boliviensis Stephani, Bibliot. Bot. **87**: 228. *f. 171 a–b. 1916.*
Triandrophyllum durum (Stephani) Fulford & Hatcher, Bryologist **61**: 279. *f. 21, 22.* 1958 [1959].
Triandrophyllum antarcticum Fulford & Hatcher, Bryologist **61**: 281. 1958 [1959], excluding specimens and synonyms.

Plants of medium to large size, brown, sometimes reddish at the tips, erect or ascending, in tufts or mats; stems 4–8 cm long, with leaves to 3 mm wide, rarely branched, the branches ventral-intercalary, leafy or flagelliform; stem in transverse section with a unistratose cortical layer of slightly smaller, thick-walled cells. Rhizoids not seen. Leaves distant to approximate, widely spreading, asymmetric, ovate to ovate-truncate, 1–2 mm long, to 1.0 mm wide, the margins spinose-dentate, with few to many teeth (more on the ventral margin), bifid or trifid to one-half of their length; segments lanceolate, acute or blunt; leaf-cells near the base of the segments 30–40 × 24–28 μ, the walls uniformly thickened, the trigones small to indistinct, the cuticle verruculose to sometimes papillose. Underleaves scarcely smaller than the leaves, bifid or trifid, appressed to widely spreading, the margins spinose-dentate below. Female inflorescence terminal on the stem or branch, without or with one or two subfloral, leafy or microphyllous innovations, the bracts and bracteoles like the leaves, slightly larger, with more teeth. Perianth with folds or keels above, divided to one-fourth of its length into six to nine segments with ciliate margins. Male inflorescence and sporophyte not seen. Fig. 2, a–f.

Habitat: On soil and over rocks in shaded areas along banks, and in open fields.

COLOMBIA: Fusagasugá, *Lindig 1722* (isotype, G); Andes Bogotá, *Weir* (as *Sendtnera jamesii*) (NY).

BOLIVIA: s.l., *Herzog* (as *I. trifida*), (G); Tablas, *Herzog 2853*, type of *Lepicolea boliviensis* (G).

PATAGONIA—TIERRA DEL FUEGO: Aysen Valley, *Dusén 1000* (G); s.l. without collector's name, type of *I. appendiculata* (G); s.l., *Dusén 292* (as *I. appendiculata* (isotype ? FH); Magellan Straits: *Hooker*, Hb. Kew "sub nomine *J. tenacifoliam*," type of *Herberta dura* (K); Chile, *Neger* (as *M. antarctica* (G); s.l., *Dusén 224* (as *M. antarctica* f. *compacta*) (G); Fuegia, *Dusén 243, 276* (G); Patagonia, *Dusén 257, 293* (G); Desolation I., Puerto Angosta, *Dusén 271* (G).

The additional reports in the literature include Herzog & Schwabe (1939), Kühnemann (1949), Reimers (1926), and Stephani (1900 a, b, 1901a, 1903a).

3. **Triandrophyllum georgiense** (Stephani) Fulford & Hatcher, Bryologist **64**: 348. 1961 [1962].

Isotachis georgiensis Stephani, Schwed. Südpolar Exped. 1901-03 4^1: 4. *f. 4.* 1905.
Herpocladium antarcticum Stephani, Sv. Vet.-akad. Handl. 46^9: 66. *f. 25 a.* 1911.

Plants small, brown, tending to be erect, radially symmetric, scattered among other bryophytes; stems slender, to 2 cm long, with leaves to 1 mm wide, simple; stem in transverse section 8–10 cells in diameter, cells of the unistratose cortical layer smaller and with thicker walls than those of the medula. Line of leaf insertion oblique, only slightly decurved at the dorsal end, with the leaves incubous. Rhizoids not seen. Leaves distant, patent, subsymmetric, ovate to ovate-truncate, concave, to 0.9 mm long, to 0.7 mm wide, the margins entire, usually with a small appendage at the dorsal base, occasionally with one or two very small teeth on the lower margins, bifid to one-half of their length; segments triangular from a broad base, acute, the sinus broad; leaf-cells at the base of the segment 24–27 × 22–24 μ, the walls uniformly thickened, the trigones very small or indistinct, the cuticle verruculose to striolate. Underleaves similar to the leaves, scarcely smaller. Male and female inflorescences and sporophyte not seen. Fig. 3, a–e.

Habitat: On the bank of a brook.

SOUTH GEORGIA: Cumberland Bay, *Skottsberg 186* (type G-1785); Cumberland Bay, *Skottsberg*, type of *Herpocladium antarcticum* (G).

4. **Triandrophyllum fernandeziense** (S. Arnell) Grölle, Bryologist **64**: 25. *f. 4, a–h.* 1961.

Acromastigum fernandeziense S. Arnell, Ark. Bot. II. 4: 10. *f. 1 a–d.* 1957.

Plants of small to medium size, olive-green becoming light brown, in cushions

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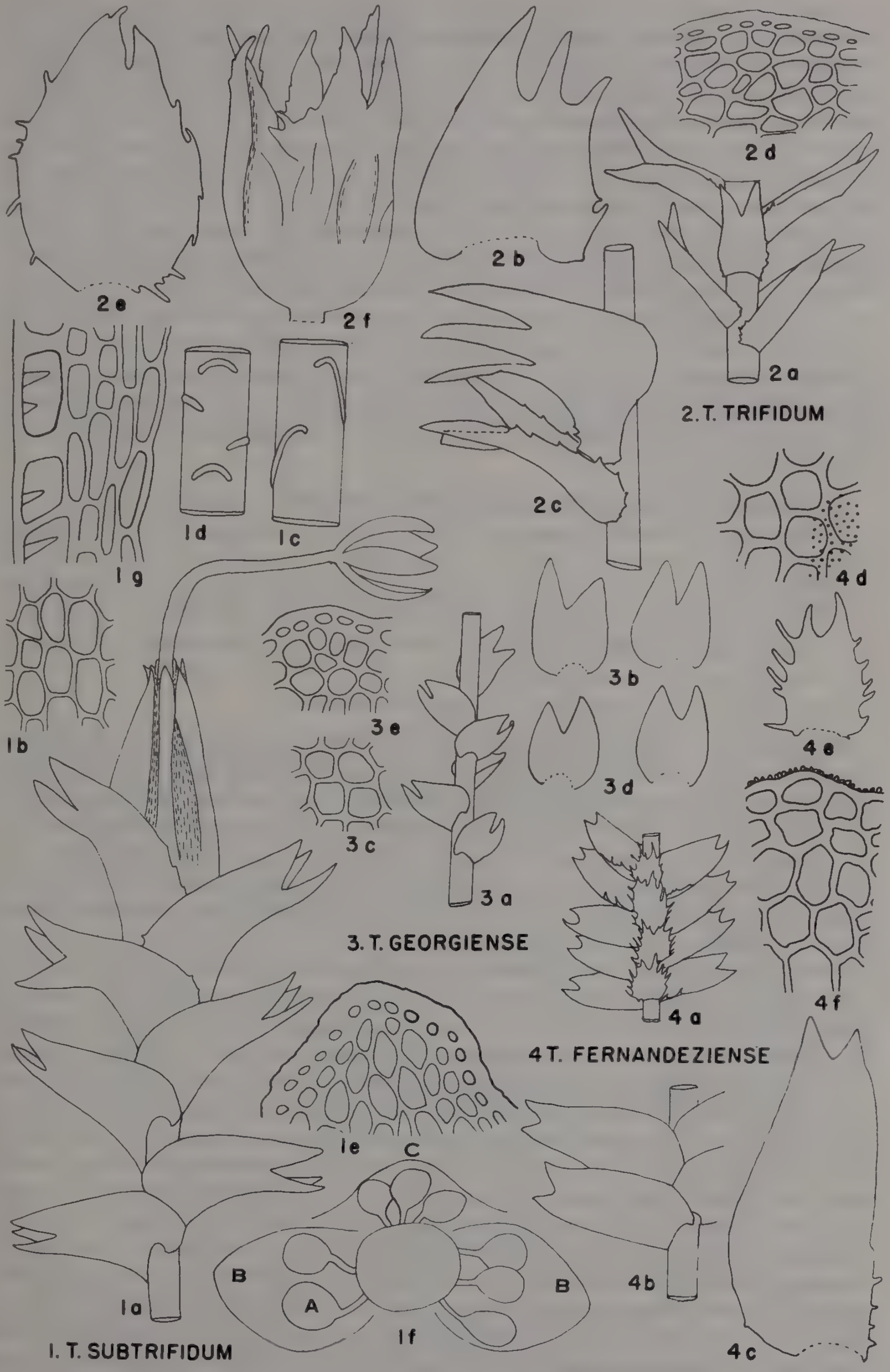
FIG. 1. *Triandrophyllum subtrifidum.* 1 a. Leafy stem with a perianth, long seta and opened capsule, dorsal view, × 10. 1 b. Leaf cells, × 180. 1 c. Diagram to show leaf insertion on the stem, dorsal view. 1 d. Diagram to show leaf insertion on the stem, ventral view. 1 e. Portion of a transverse section of a stem, × 180. 1 f. Diagram of a transverse section through a male inflorescence, × 30. 1 g. Portion of a transverse section of the capsule wall, × 350; the large cells are of the outermost layer.

FIG. 2. *T. trifidum.* 2 a. Portion of a stem, ventral view, × 10. 2 b. Leaf, × 18 (type). 2 c. Portion of a stem with trifid leaves and underleaves, × 18. 2 d. Portion of a transverse section of a stem, × 180. 2 e. Female bract of the inner series, × 18. 2 f. Perianth [immature] with serrate to ciliate segments, × 25.

FIG. 3. *T. georgiense.* 3 a. Stem, dorsal view, × 10. 3 b. Leaves, × 10. 3 c. Cells of the median portion of a leaf, × 180. 3 d. Underleaves, × 10. 3 e. Portion of a transverse section of a stem, × 80.

FIG. 4. *T. fernandeziense.* 4 a. Stem, ventral view, × 30. 4 b. Stem, dorsal view, × 33. 4 c. Leaf, × 90. 4 d. Leaf cells, × 340. 4 e. Underleaf, × 90. 4 f. Portion of a transverse section of a stem, × 350.

FIG. 1 a–g, 2 c–e, and 3 a–e after Fulford & Hatcher, 1958; 4 a, after Arnell, 1957.


2 e
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A
B
1 f
1 a
4 b
4 c

2. T. TRIFIDUM

3. T. GEORGIENSE

4 T. FERNANDEZIENSE

1. T. SUBTRIFIDUM

or mats; stems slender, to 4 cm long, with leaves to 3 mm wide, irregularly branched, the branches ventral-intercalary, long, leafy or flagelliform; stem in transverse section with the cells of the cortical band in one or two layers, thick-walled and smaller than the cells of the medulla. Rhizoids not seen. Leaves widely spreading, long, narrowly ovate to oblong-ovate, to 1.3 mm long, to 6 mm wide, asymmetric, the dorsal margin convex, entire, or with an occasional tooth near the base, the ventral margin with spines and cilia in the lower half, the ventral base more or less auriculate, bifid to one-fifth or one-fourth of their length; segments triangular from a 4- to 6-celled base, acute, the sinus broad, rounded; leaf-cells of the base of the segments 18–28 × 18 μ, the walls uniformly thickened, the trigones small, the cuticle coarsely papillose. Underleaves ovate, to 5.06 mm long, 0.3 wide (the lamina), less than half the length of the leaf, bifid, the margins long-spinose to ciliate. Plants dioicous. Male inflorescence terminal (becoming intercalary?), the bracts and bracteoles in few pairs, similar to the leaves and underleaves, slightly larger, more or less pouched, antheridia in the axils of both the bracts and bracteoles. Female inflorescence and sporophytes not seen. Fig. 4, a–f.

Habitat: On bark and branches in humid forest.

JUAN FERNANDEZ: Masatierra, above Plazoleta del Yunque, *C. & I. Skottsberg* (type S-PA).

Taxa not seen:

Isotachis georgiensis var. *fuegiensis.* Gola, Nuovo Gior. Bot. Ital. **29**: 170. 1923.

Herberta S. F. Gray, Nat. Arr. Brit. Pl. **1**: 705. 1821.

Schisma Dumortier, Comm. Bot. 114. 1822.

Sendtnera C. G. Nees in G. L. & N. Syn. Hep. 238. 1844.

Leafy plants yellowish to brown, often becoming reddish or purple, ascendent to erect, or pendent, from a prostrate rhizome (often obscure) with scale-like leaves; leafy stems of medium size or robust, to 30 cm long, or thin and delicate and very short, sparingly irregularly branched; branches rarely lateral, of the *Frullania* type, with the lanceolate half-leaf at the dorsal base, more frequently intercalary, from the axils of the underleaves or from the stem at the ventral base of the leaf or either side of the underleaf, leafy or flagelliform; stem in transverse section with a cortical band of one to three layers of cells with thick, deep brown to yellow walls, and a medulla of many larger cells with progressively thinner walls toward the middle, the pits numerous. Rhizoids thin-walled, from cells of the lower part of the underleaf or the scale-leaves of the flagelliform branches. Line of leaf insertion transverse. Leaves elongate to subquadrate, symmetric to asymmetric, deeply bifid (rarely trifid), the segments linear to lanceolate, the margins entire, serrate, toothed or appendiculate, especially near the base; vitta of narrow, elongate, thick-walled cells always present, bifurcating near the base of the leaf or just below the sinus, ending below the tips of the segments or in the tips; oil bodies four to eight per cell (at least in some species) round to oval, homogenous. Underleaves as large as the leaves, similar, symmetric. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem, the bracts and bracteoles like the underleaves, pouched; antheridia large, spherical, usually in pairs in the axils of both the bracts and the bracteoles, the stalk of two rows of cells. Female inflorescence terminal on the leafy stem or long branch, with one or two subfloral innovations of unlimited growth, the inflorescence appearing to be on a short lateral or ventral branch, the bracts and bracteoles similar, in three to six series, increasing in size and degree of marginal serration from the leaves to the perianth, paraphyses often present among the bracts. Perianth fusiform, more or less 3-keeled, the third keel ventral, with three supplementary folds, divided to the middle into three bilobed (trilobed) divisions; slime papillae on the margins and surface of the segments. Shoot/sporophyte relationship a shoot-calyptra. Sporophyte capsule spherical, dark brown to black, the wall to 100 μ thick, of five to seven layers of cells, the outer layer with characteristic red-brown knots on the outer radial walls, the innermost layer with half-rings on the inner tangential wall; elaters bispiral to the tips. Spores yellow to brown. Vegetative reproduction by means of leaf cladia from single dedifferentiated cells of old leaves and underleaves.

Type species: *Jungermannia juniperoidea* Swartz.

The genus is readily recognized in the field because of its large size, habit, and the three rows of very similar, deeply bifid leaves and underleaves. For the most part, the species are more difficult to separate, since the most dependable diagnostic characters are microscopic.

There is considerable variation within any species, mostly in the size of the stems, the length of the leaves and underleaves, the number of appendages on the margins of the lamina of the leaves and underleaves, and the degree of thickening, but not the pattern, of the cell walls.

The genus is found primarily in elevated regions of the tropics but there is one species in Patagonia and several others in the Northern Hemisphere.

Key to the Species

1. Plants of southern Chile and Patagonia. 11. *H. runcinata.*
1. Plants of tropical, subtropical, or warm-temperate Latin America.
  2. Leaves and underleaves more than twice as long as wide.
    3. Segments of the leaves and underleaves coarsely to faintly serrate 6. *H. serrata.*
    3. Segments of the leaves and underleaves entire (rarely with an occasional small tooth).
      4. Segments ending in a long-acuminate tip.
        5. Cells of the tip and the upper part of the segment subquadrate. 5. *H. acanthelia.*
        5. Cells of the tip and the upper part of the segment long rectangular. 7. *H. limbata.*
      4. Segments of the leaves and underleaves acute, or acuminate by only two or three cells.
        5. Vitta of the lamina bifurcate at about the middle; segments of the underleaves widely divergent. 3. *H. divergens.*
        5. Vitta of the lamina bifurcate just below the sinus; segments of the underleaves erect or a little divergent.
          6. Segments long, linear, the vitta covering most of the width of the base, extending to the tip. 2. *H. pensilis.*
          6. Segments lanceolate, the vitta covering about half the width of the base, ending well below the apex.
            7. Lamina at least twice as long as broad. 4. *H. grossispina.*
            7. Lamina only a little longer than broad.
              8. Leaf-cells with thick, uneven walls; plants of tropical areas. 1. *H. juniperoidea.*
              8. Leaf-cells with large, triradiate trigones and thin-walled pits; plants of southern South America. 11. *H. runcinata.*
  2. Leaves and underleaves less than twice as long as broad.
    3. Vitta of the lamina bifurcating near the base.
      4. Margins of the leaves and underleaves with a few sharp teeth; leaf-cells with thick walls, the pits rarely visible. 8. *H. angustivittata.*

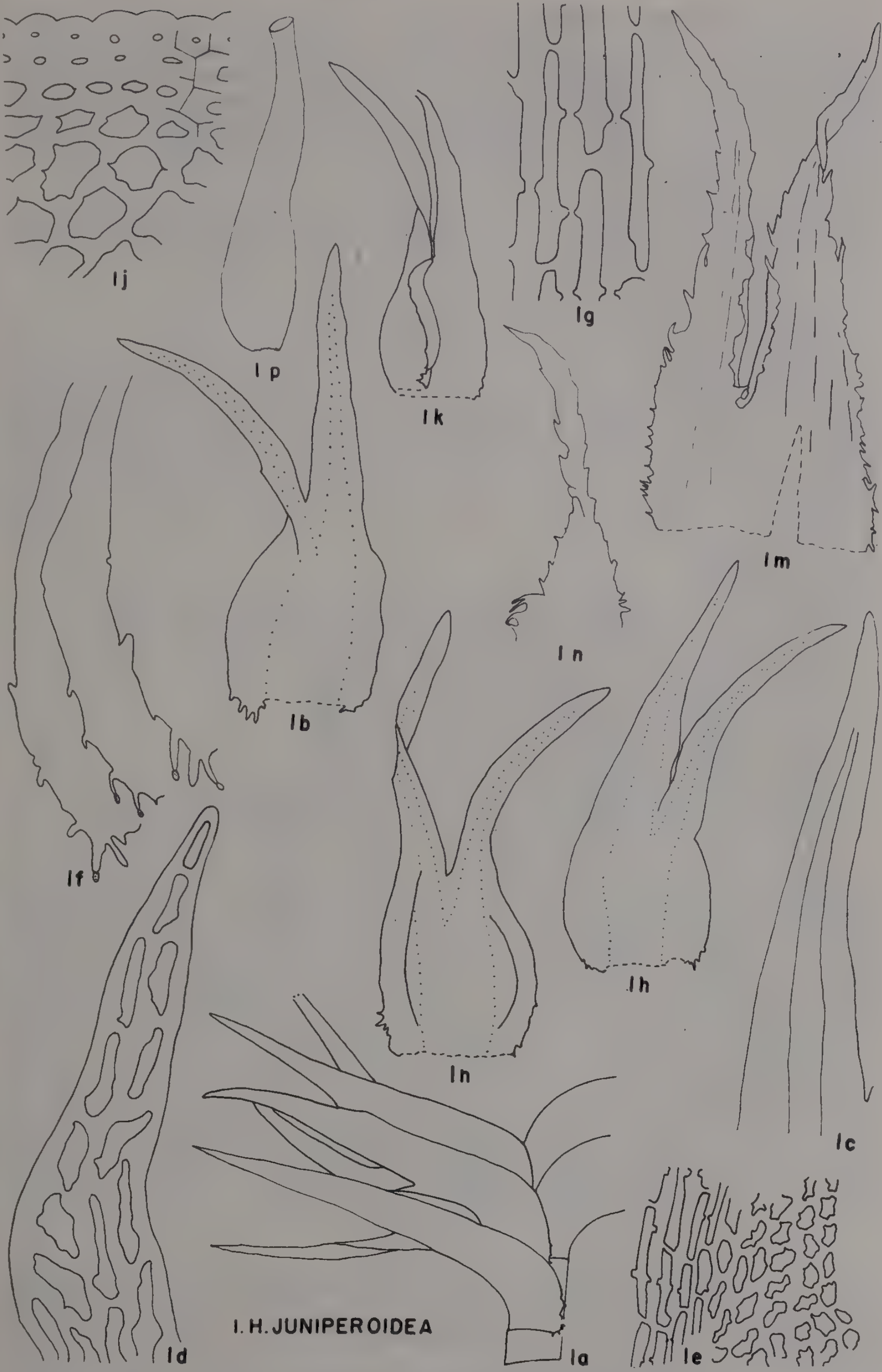
- 4. Margins of the leaves and underleaves entire.
  - 5. Segments short, acute from a very broad base; the vitta covering only about one-eighth of the base of the segment; leaf-cells with unevenly thickened walls, the trigones and thin-walled pits not conspicuous. 9. *H. bivittata.*
  - 5. Segments long-acuminate from a broad or narrow base, the vitta covering one-fourth to one-half the base of the segment; leaf-cells with very large knot-like thickenings, triradiate trigones, and thin-walled pits. 10. *H. subdentata.*
- 3. Vitta of the lamina bifurcate only a little below the sinus.
  - 4. Apex of the segments long-acuminate by three to eight or more cells.
    - 5. Cells of the tip subquadrate. 5. *H. acanthelia.*
    - 5. Cells of the tip long-rectangular. 7. *H. limbata.*
  - 4. Apex of the segments acute or acuminate by only two or three cells. 11. *H. runcinata.*

1. **Herberta juniperoidea** (Swartz) Grolle, Revue Bryol. Lichénol. **30**: 80. 1961.

Jungermannia juniperoidea Swartz, Prodr. 144. 1788.
Jungermannia juniperina Swartz, Fl. Ind. Occid. 3: 1855. 1806.
Schisma juniperina (Swartz) Dumortier, Rec. Obs. Leberm. 23. 1836.
Mastigophora juniperina (Swartz) C. G. Nees, Hep. Eur. 3: 573. 1838.
Sendtnera juniperina (Swartz) C. G. Nees in G. L. & N. Syn. Hep. 239. 1844.
Herbertia juniperina (Swartz) Trevisan, Mem. Ist. Lomb. III. 4: 397. 1877.

Plants of medium to large size, light greenish-brown to dark brown, in tufts or pendent; leafy stems to 20 cm long, with leaves to 2 mm wide (when dry), sparingly irregularly branched, the branches both lateral, of the *Frullania* type and leafy, and intercalary, leafy or flagelliform; stem in transverse section or two or three layers of small, thick-walled cells surrounding the larger cells of the medulla. Rhizoids from the scale-leaves of the flagelliform branches. Leaves spreading, the bases imbricate, more or less asymmetric, 3–4 mm long, 1–1.5 mm wide, bifid to one-half of their length; segments long, lanceolate, curved, tapering to the acute apex, the margins entire, the vitta half the width of the base of the segment, ending below the tip; lamina ovate, with marginal appendages bearing slime papillae near the base, the vitta bifurcate a little below the sinus; leaf-cells thick-walled from coalesced trigones and intermediate thickenings, the walls uneven, the cuticle verruculose. Underleaves as large as the leaves, similar, symmetric, the segments straight or divergent. Plants dioicous. Male inflorescence terminal, becoming intercalary on the stem, the bracts and bracteoles like the underleaves, the lamina pouched; antheridia large, spherical, in pairs in the axils of both bracts and bracteoles. Female inflorescence terminal on the stem, with one subfloral innovation—soon appearing to be on a short branch, the bracts and bracteoles in four to six series, increasing in size and elaboration to the innermost series, the bracts of the innermost series serrate, dentate, and ciliate on the margins. Perianth 3-parted to the middle, the divisions bilobed, the margins serrate, dentate, and ciliate. Sporophyte not seen. Fig. 1, a–p.

FIG. 1. *Herberta juniperoidea.* 1 a. Stem, dorsal view, × 18. 1 b. Leaf, × 18; the vitta outlined by dots. 1 c. Leaf segment, × 33. 1 d. Cells of the tip of the leaf segment, × 350. 1 e. Cells from the base of the leaf segment, × 180. 1 f. Leaf bases, × 50. 1 g. Cells of the vitta, × 350. 1 h. Underleaves, × 18. 1 j. Portion of a transverse section of a stem, × 350. 1 k. Male bract, × 18. 1 m. Segments of a female bract of the innermost series, × 18. 1 n. Segment of the perianth mouth, × 33. 1 p. Archegonium, × 50.


1j
1p
1k
1g
1m
1b
1f
1n
1h
1n
1d
1c
1a
1e

1. H. JUNIPEROIDEA

Habitat: On trees in forests.

JAMAICA: s.l., *Swartz*, type, (isotype, NY); Blue Mountain Peak, *Bengry 102* (IJ), *Proctor 1120* (IJ), *Maxon, 10009* (US), *Orcutt 2855* (BM, US); between Portland Gap and Blue Mountain Peak, *Bengry 256, 274* (IJ); Cuna Cuna Mountain, *M. Farr 1380* (IJ); Maccasucker Bump, St. Thomas, *Maxon 9577* (IJ); Morce's Gap, *Bengry 305* p.p. (IJ); Mossman's Peak, *Maxon 9756* (US); summit of John Crow Peak, *M. Farr 967* (IJ), *Philipson 844c, 1083* (BM); Sir Johns Peak, *Lewis 96* (IJ); summit of Sugar Loaf, *M. Farr 1083, 1092* p.p., *1095* p.p., *1096* p.p. (IJ).

DOMINICAN REPUBLIC: La Vega: Loma Compana, *Allard 18553* (US).

PUERTO RICO: El Duque, *Steere 4109* (NY); summit of La Virgin, *Steere 8265* (NY); El Tuna, *Steere 6467* (NY); s.l., *Pagán 493, 546* (NY).

ST. KITTS: s.l., Hampe Hb. (NY).

ST. VINCENT: Mt. St. Andrews, *Elliott 70 d, 80 c* (BM).

TRINIDAD: s.l., *Simmons 454* (Hb. Simmons).

ECUADOR: Tungurahua, *Spruce, Hep. Spruc.* (isotype NY); Quito, *Jameson* (mixture) (NY).

Additional reports of the species are to be found in the following literature: Antilles (Bescherelle, 1893; Husnot, 1875; Stehlé, 1957; Stephani, 1904); Cuba (Welch, 1950); Jamaica (Nees, 1831. Pagán, 1939); Guadeloupe, (Pagán, 1942; Pearson, 1922); St. Vincent (Spruce, 1895); Mexico, (Gottsche, 1863), Costa Rica (Stephani, 1893a); British Guiana (Stephani, 1901c); Brazil (Stephani, 1903a); Ecuador (Mitten, 1851); and Peru, (Hampe, 1854).

2. **Herberta pensilis** (T. Taylor) Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 341. 1885.

Sendtnera pensilis T. Taylor, London Jour. Bot. 5: 372. 1846.
Herbertia pensilis (T. Taylor) Trevisan, Mem. Ist. Lomb. III. **4**: 397. 1877.
Herberta costaricensis Stephani, Bull. Soc. Bot. Belg. **31**: 178. 1893.
Schisma costaricensis Stephani, Spec. Hep. **4**: 16. 1909.
Schisma angustifolium Stephani, Spec. Hep. **4**: 17. 1909.
Schisma commutatum Stephani, Spec. Hep. **4**: 17. 1909.
Schisma trabeculatum Stephani, Spec. Hep. **4**: 18. 1909.
Schisma columbiae Stephani, Spec. Hep. **6**: 357. 1922.
Herberta armitagei Pearson, Jour. Bot. London **60**: 224. 1922.
Herberta commutata (Stephani) Pearson, Jour. Bot. London **60**: 225. 1922.
Herberta angustifolia (Stephani) Herzog, Revue Bryol. Lichénol. **11**: 24. 1938.
Schisma setaceum Stephani ms. Icones Hep. *Schisma*, no. 40. Nomen nudum.

Plants long, slender, light yellowish-green to yellow-brown, in loose tufts, pendulous from trees; stems slender, to 30 cm or more long, with leaves mostly 1 mm wide, rarely branched, the branches mostly ventral, leafy. Rhizoids not seen. Line of leaf insertion transverse. Leaves very widely spreading, the bases imbricate, slightly asymmetric, long, rectangular, to 4 mm long, less than 1 mm wide at the base, bifid to one-half of their length; segments long, linear, acute to acuminate by one or two cells, entire, the vitta strong, three-fourths of the width of the base of the segment, extending to the tip of the segment; lamina long, with only occasional decurved cilia at the base, the vitta bifurcate at the sinus; leaf-cells thick-walled, the trigones occasionally distinct, thin-walled pits occasional, the cuticle coarsely verruculose. Underleaves as large as and like the leaves, squarrose when moist, symmetric. Plants dioicous. Male inflorescence

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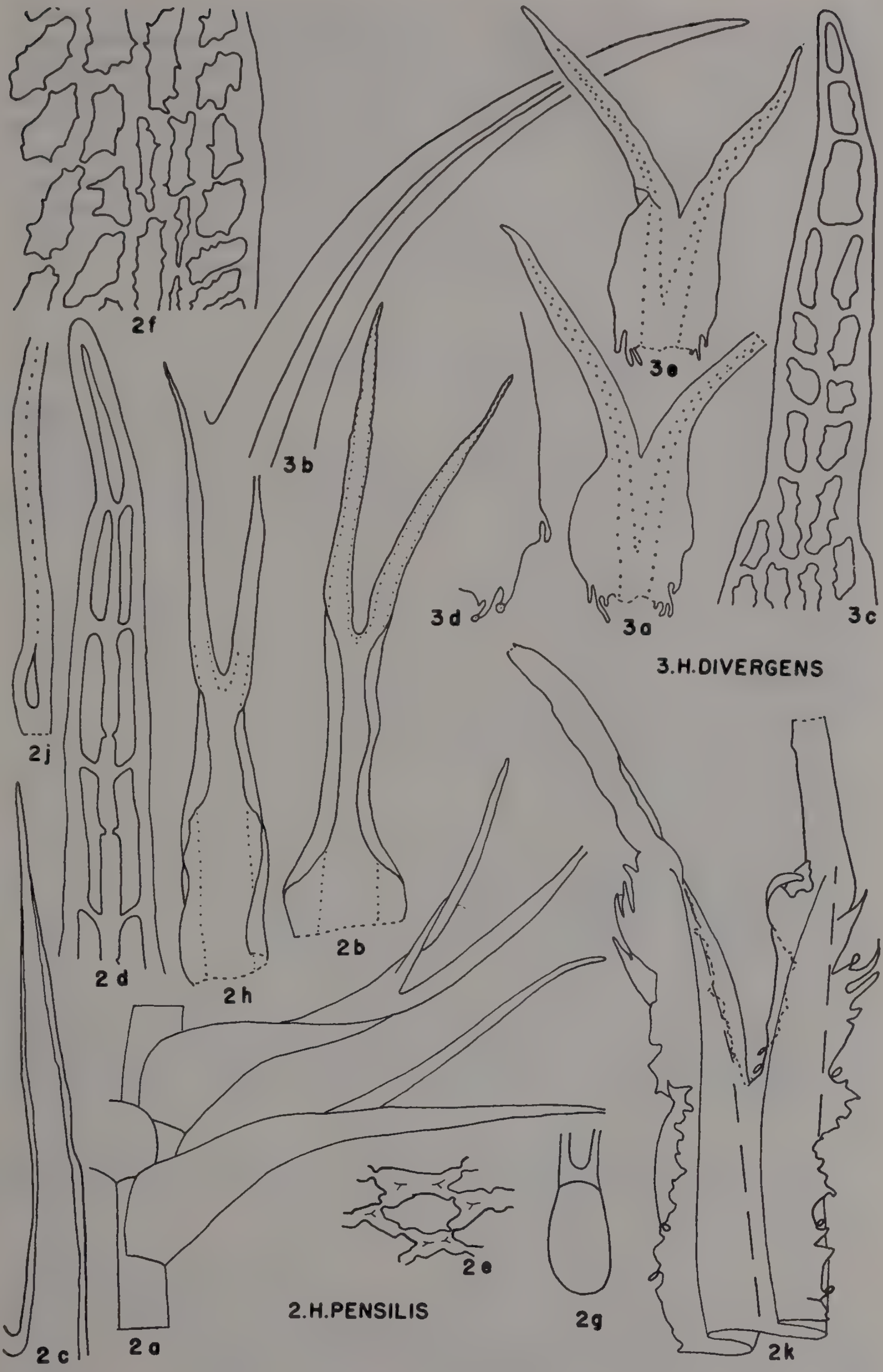
FIG. 2. *Herberta pensilis.* 2 a. Stem, dorsal view, × 18. 2 b. Leaf, the vitta outlined, × 18. 2 c. Segment of a leaf, × 33. 2 d. Apex of a leaf segment, × 350. 2 e. Cell from the dorsal base, × 350. 2 f. Cells from the base of a segment, × 350. 2 g. Slime papilla, × 350. 2 h. Underleaf, × 18. 2 j. Archegonium, × 85. 2 k. Segments of the perianth mouth, × 33.

FIG. 3. *H. divergens.* 3 a. Leaf, × 18. 3 b. Segment of a leaf, × 33. 3 c. Cells of the tip of a leaf segment, × 350. 3 d. Basal margin of a leaf, × 50. 3 e. Underleaf, × 18.


2f
2j
2d
2h
3b
2b
3e
3d
3a
3c
3.H.DIVERGENS
2c
2a
2e
2.H.PENSILIS
2g
2k

terminal on the stem, but becoming intercalary, the bracts and bracteoles similar and like the leaves and underleaves, the lamina deeply concave; antheridia large, spherical, in pairs in the axils of both bracts and bracteoles. Female inflorescence with one subfloral innovation of unlimited growth, thus appearing to be on a short branch, the bracts and bracteoles similar, in three to five series, showing a gradual transition from leaves to the larger, innermost series, the lamina deeply folded, the margins incised to lacinate, the narrow segment-margins undulate. Perianth scarcely exserted, deeply folded below, divided to one-half of its length into three, bifid parts, the segments and the margins similar to the margins of the innermost bracts. Sporophyte not seen. Fig. 2, a–k.

Habitat: On trees in forests.

CUBA: Oriente, crest of Sierra Maestra, *Morton 9545* p.p. (US).

PUERTO RICO: Monte Yunque, *Sintensis*, type of *S. angustifolium* (G); Sierra de Luquilla, *Steere 5940* (NY).

DOMINICA: Morne Micotrin, *Elliott 9* p.p., *99c, 106, 1092a, 1230d* (BM); Roseau Valley, *Elliott 11* (BM); Morne Trois Pitons, *Elliott 479d, 729c* p.p., *2259a, 2306* (BM); Morne Diablotin, *Elliott 641a, 669c, 1010, 1060* (♀), *1060a* p.p., *1078b* p.p., *1083e* (BM); Mountain Lake, *Armitage*, type of *H. armitagei* (MANCH).

COSTA RICA: Heredia: Cerros de Zurqui, 2000–2400 m, *Standley & Valerio* (as *H. angustifolia*) 50292, 50520 (Hb. Herzog); s.l., *Brenes 16207* (F); forêts du Barba, *Pittier 6048*, type of *H. costaricensis* (G);

COLOMBIA: s.l., Cardot misit, type of *S. columbiae* (G).

BRITISH GUIANA: Roraima, *McConnell & Quelch 522*, type of *S. trabeculatum* (G); s.l., *Quelch* (as *S. commutatum*) (G).

BRAZIL: Roraima, *Ule 653*, type of *S. setaceum* (G); Roraima, *Ule 652* (as *S. angustifolium*) (G).

ECUADOR: Andes Quitenses: Mt. Chimborazo, *Spruce, Hep. Spruc.* (lectotype, NY)*; Pichincha, Jameson (NY). *Spruce*, type of *S. commutata* (G).

PERU: Lachapata, *Lechler 3104b* (NY).

BOLIVIA: near Apolo, 5500 ft., *Williams 2173* (NY).

The additional reports in the literature include Costa Rica (Herzog, 1938a; Pearson, 1922) and Bolivia (Herzog, 1934b).

3. **Herberta divergens** (Stephani) Herzog, Hedwigia **74**: 94. 1934.

Schisma divergens Stephani, Spec. Hep. **4**: 10. 1909.
Schisma lacerifolium Stephani, Spec. Hep. **4**: 10. 1909.
Herberta bivittata var. *latiloba* Herzog, Revue Bryol. Lichénol. **11**: 24. 1938.
Herberta penicillata Herzog, Revue Bryol. Lichénol. **11**: 29. *f. 6, a–e.* 1938.
Herberta ovifolia K. Müller, Repert. Sp. Nov. **58**: 68. 1955.

Plants of medium size, brown, in tufts or pendent; stems to 15 cm long, with leaves to 2 mm wide (when dry), rarely branched, the branches leafy. Line of leaf insertion transverse. Leaves tending to be falcate-secund or irregularly spreading when dry, 3–4 mm long, to 1.5 mm wide at the ovate base, bifid to about one-half of their length; segments spreading, lanceolate, tapering to a 2-

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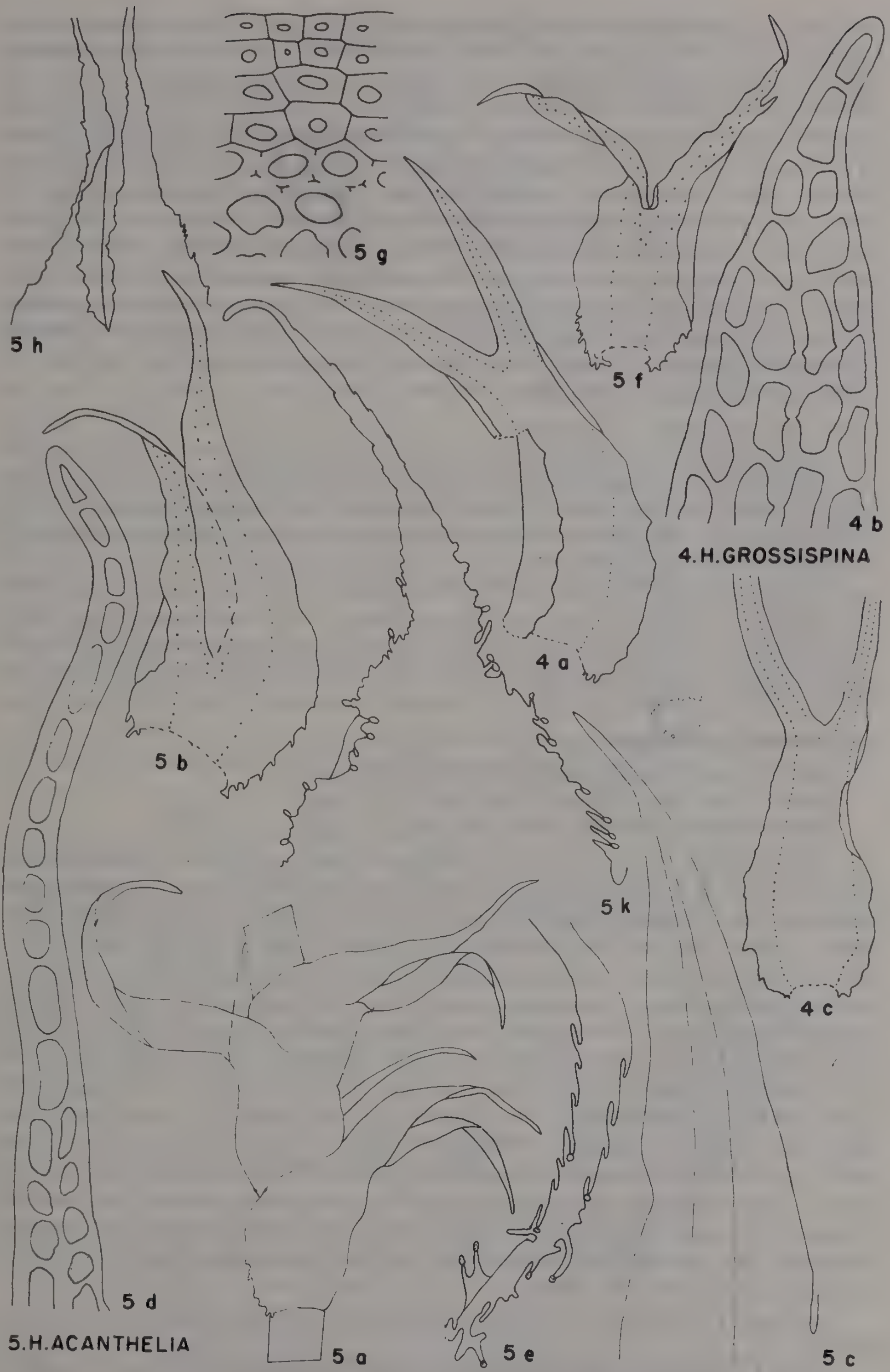
*The original collection by Jameson in Ecuador is a mixture of several species of *Sendtnera*, so to avoid further confusion the collection by Spruce on Mt. Chimborazo is designated as the lectotype of the species.

FIG. 4. *Herberta grossispina.* 4 a. Leaf, × 18. 4 b. Cells of the tip of a leaf segment, × 350. 4 c. Underleaf, × 18.

FIG. 5. *H. acanthelia.* 5 a. Stem, dorsal view, × 18. 5 b. Leaf, × 18. 5 c. Leaf segment, × 33. 5 d. Cells of the tip of a leaf, × 350. 5 e. Leaf bases, × 50. 5 f. Underleaf, × 18. 5 g. Portion of a transverse section of a stem, × 350. 5 h. Segments of a female bract, × 18. 5 k. Segment of the mouth of a perianth, × 50.


5 h
5 g
5 f
4 b
4.H.GROSSISPINA
5 b
4 a
5 k
4 c
5 d
5.H.ACANTHELIA
5 a
5 e
5 c

3-celled tip, the margins entire, the vitta only half as wide as the segment base, ending well below the apex; leaf-cells thick-walled, the trigones and pits rarely distinct, the margins irregular, the cuticle verruculose; lamina ovate, the margins often incised, toothed, or ciliate at the base, the vitta forked near the base, continuing as two distinct ribs into the segments. Underleaves as large as the leaves, the lamina less ovate, the segments conspicuously divergent. Plants dioicous. Male inflorescence terminal but becoming intercalary on the stem, the bracts and bracteoles as large as the leaves and underleaves, pouched; antheridia large, spherical, in pairs in the axils of the bracts and bracteoles. Female inflorescence terminal on the stem, with one subfloral innovation, the bracts and bracteoles in four or five series, the innermost series largest, with a long lamina with decurved marginal teeth and cilia, the segments divergent, linear. Perianth (immature) 3-parted to near the middle, the divisions deeply bilobed, the segments narrow, linear. Sporophyte not seen. Fig. 3, a–e.

Habitat: On trees in forests.

PUERTO RICO: s.l., *Sintenis H 26*, type of *S. lacerifolium* (G).

COSTA RICA: near Buenos Aires, *Tonduz 15674*, ex Hb. Levier (type G); San José: La Palma, 1600 m, *Standley 38080* type of *H. penicillata* (Hb. Herzog); Laguna de la Chonta (on *Sphagnum*) *Standley 42338;* Cartago: near Pejivalle, *Standley & Valerio 47021*, type of *H. vittata* var. *latiloba* (Hb. Herzog).

BRAZIL: Rio Vaupés Jutica, *Lützelberg 23822a* (Hb. Herzog); S. Paulo, Alto da Serra, *Hoehne* (Hb. Herzog).

BOLIVIA: above Comarapa, 2600 m, *Herzog 4230a* (♂) (Hb. Herzog); Río Verde, Serrania Ricardo Franco, *E. Schmidt*, isotype of *Herberta ovifolia* (Hb. Herzog).

The species has also been reported in the literature from Cuba (S. Arnell, 1956) and Bolivia (Herzog, 1934b).

4. **Herberta grossispina** (Stephani) Fulford, comb. nov.

Schisma grossispinum Stephani, Spec. Hep. **4**: 10. 1909.
Schisma grandifolium Stephani, Spec. Hep. **4**: 18. 1909.
Schisma ulophyllum Herzog, Repert. Sp. Nov. **21**: 27. *pl. 11, f. 4.* 1925.

Plants large, light green to greenish-brown, in tufts or pendent; stems slender, to 30 cm long, often shorter, when dry mostly 1.5 mm wide, occasionally branched, the branches lateral or ventral, leafy. Line of leaf insertion transverse. Leaves more or less falcate-secund and the stem-tip curved when dry, or irregularly spreading, subrectangular, imbricate at the base, bifid to less than one-half of the length; segments shorter than the lamina, lanceolate, tapering to the 1–2-celled tip, the margins entire, the vitta about one-fourth to one-half the width of the base of the segment, ending below the apex; lamina long, with a few marginal teeth or cilia near the base, the vitta bifurcate just below the sinus; leaf-cells thick-walled, the trigones and thin-walled pits occasionally distinct, the cuticle verruculose. Plants dioicous. Female inflorescence terminal, with one subfloral innovation, appearing lateral, the bracts and bracteoles in four or five series, the innermost series with crenulate and toothed margins. Perianth (immature) deeply 3-parted, each part deeply bifid, the segments lanceolate, the margins dentate and crenulate as in the bracts. Male inflorescence and sporophytes not seen. Fig. 4, a–e.

COLOMBIA: El Valle: La Cumbre, 2150–2400 m, *Pennell & Killip 5806* (US, Hb. Herzog).

BRAZIL: Serra dos Orgãos, Morro Assú, 2400 m, *Lützelburg 6719*, type of *S. ulophyllum, 6175a, 7191* (Hb. Herzog).

ECUADOR: Tungurahua, *Spruce*, type of *S. grandifolium* (G).

BRITISH GUIANA: Mt. Roraima, *Quelch* (type G); Roraima, *McConnell 528* (as *S. grandifolium*) (G).

5. **Herberta acanthelia** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 341. 1885.

Schisma acanthelium (Spruce) Stephani, Spec. Hep. **4**: 11. 1909.
Schisma lechleri Stephani, Spec. Hep. **4**: 12. 1909.
Schisma granatense Stephani, Spec. Hep. **4**: 14. 1909.
Schisma boliviense Stephani, Spec. Hep. **6**: 358. 1922.
Herberta boliviensis (Stephani) Herzog, Repert. Sp. Nov. **58**: 68. 1955.
Herberta inaequalis Herzog, Sv. Bot. Tidskr. **46**: 81. *f. 14.* 1952.

Plants of medium size, dark brown to blackish, in tufts; stems stout, to 15 cm long, with leaves 2–3 mm wide (when dry), rarely branched. Line of leaf insertion transverse. Leaves irregularly spreading, the bases imbricate, strongly asymmetric, falcate, 3–4 mm long, to 1.6 mm wide at the base, unequally bifid to one-half of their length; segments broadly triangular, tapering to an acuminate, 3–8-celled apex, the cells quadrate in outline, the dorsal segment broad, the vitta about one-fourth the width of the base of the segment, ending well below the apex, the ventral segment smaller, decurved; lamina broadly ovate, the dorsal margin strongly convex, long-ciliate in the lower half, the vitta bifurcate a little below the sinus; leaf-cells with rounded trigones and intermediate thickenings separated by thin-walled pits, the cuticle rough. Underleaves as long as the leaves, symmetric, the vitta, apices and cells as in the leaf. Plants dioicous. Female bracts and bracteoles in four to six series, the innermost series large with deep folds, the margins of the lamina ciliate, the numerous multicellular cilia decurved, the segments broadly triangular, long-pointed, the margins ciliate and serrate. Perianth (immature) deeply 3-parted, the divisions bilobed; segments long-tapering from a very broad base, the margins ciliate and serrate, the slime papillae numerous. Male inflorescence and sporophyte not seen. Fig. 5, a–k.

Habitat: On trees, mountain forests.

COLOMBIA: Páramo de Sonson, without collector, type of *S. granatense* (G); Los Gagues, 10,700 ft, *Alston 7487b* (BM); Andes Bogotenses, *Weir* (NY).

ECUADOR: Azuay: Sevilla de Oro, 3400 m, *Harling 2338*, type of *H. inaequalis* (Hb. Herzog); s.l., *Espinoza* (Hb. Herzog); Tungurahua, *Spruce, Hep. Spruce, type* (isotypes NY, G); El Altar, 4000 m, *Meyer* (Hb. Herzog).

PERU: Tatanara, *Lechler*, type of *S. lechleri* (G).

BOLIVIA: between San Mateo and Sunchal, *Herzog 4494*, type of *H. boliviense* (type G, isotype Hb. Herzog); N. Yungas, *E. Schmidt* (HB. Herzog); Vallio Pajonal, 4000 m, *Herzog 3256* (as *S. limbatum*) (Hb. Herzog).

The report in the literature from Costa Rica (Stephani, 1893a), probably refers to *H. limbata.*

This species is readily recognized by its large, asymmetric leaves, with uniseriate tips of three to eight quadrate cells.

6. **Herberta serrata** Spruce, Mem. Torrey Club **1**: 128. 1890.

Schisma serratum (Spruce) Stephani, Spec. Hep. **4**: 115. 1909.
Schisma brasiliense Stephani, Spec. Hep. **4**: 16. 1909.
Schisma subserratum Stephani, Spec. Hep. **4**: 17. 1909
Schisma capillifolium Herzog, Repert. Sp. Nov. **21**: *26. pl. 11, f. 3.* 1925.
Herberta cancerina Herzog, Revue Bryol. Lichénol. **11**: 25. *f. 4 a–d.* 1938.
Herberta stenoschizon Herzog, Revue Bryol. Lichénol. **11**: 27. *f. 5 a–d.* 1938.
Herberta pectinata Herzog, Revue Bryol. Lichénol. **11**: 27. *f. 4 e–g.* 1938.

Plants of medium to large size, brown with yellow-brown tips, in tufts; stems coarse, to 15 cm long, with leaves to 3 mm wide, rarely branched, the branches leafy. Line of leaf insertion transverse. Leaves irregularly spreading, the bases imbricate, 3.5–4 mm long, 1–1.3 mm wide, unequally bifid to one-half of their length; segments lanceolate, tapering to a tip of one or two cells, the margins obscurely to coarsely serrate or dentate, the vitta at least half as wide as the base of the segment, ending some distance below the apex; lamina more or less ovate, the margins with appendages in the lower half, the vitta bifurcate just below the sinus. Plants dioicous. Female inflorescence terminal on the stem, with one or two subfloral innovations, the bracts and bracteoles of the innermost series coarsely serrate. Perianths deeply 3-parted, the divisions deeply bilobed, the segments serrate as in the female bracts. Male inflorescence and sporophyte not seen. Fig. 6, a–e.

Habitat: On trees in forests.

COSTA RICA: Heredia: Cerros de Zurqui 2000–2400 m, *Standley & Valerio 50392*, type of *H. stenoschizon*, *50529* (Hb. Herzog); Yerba Buena, 2000 m, *Standley & Valerio*, *50011*, (as *H. cancerina*); Cerro de Las Lajas, 2000–2400 m, *Standley & Valerio 51629*, type of *H. cancerina* (Hb. Herzog); Cerros de Zurqui, *Standley & Valerio 50642*, type of *H. pectinata* (Hb. Herzog).

BRAZIL: Serra do Orgãos, Morro Assú, 2000 m, *Lützelberg 6883a*, type of *S. capillifolium*; *Lützelberg 6732* (as *S. serratum*) (Hb. Herzog); Caraça, *Wainio*, type of *S. subserratum* (G); St. Catarina, Campo dos Padres, *Reitz 2442* (HBR); Itatiaia, *Ule*, type of *S. brasiliense* (G).

BOLIVIA: Unduavi, 10,000 ft., *Rusby 3084*, (type NY); above Comarapa, *Herzog 3939* (Hb. Herzog).

In addition, the species has been reported in the literature from Bolivia (Herzog, 1934b).

7. **Herberta limbata** (Stephani) Herzog, Revue Bryol. Lichénol. **11**: 14. 1938 [1939].

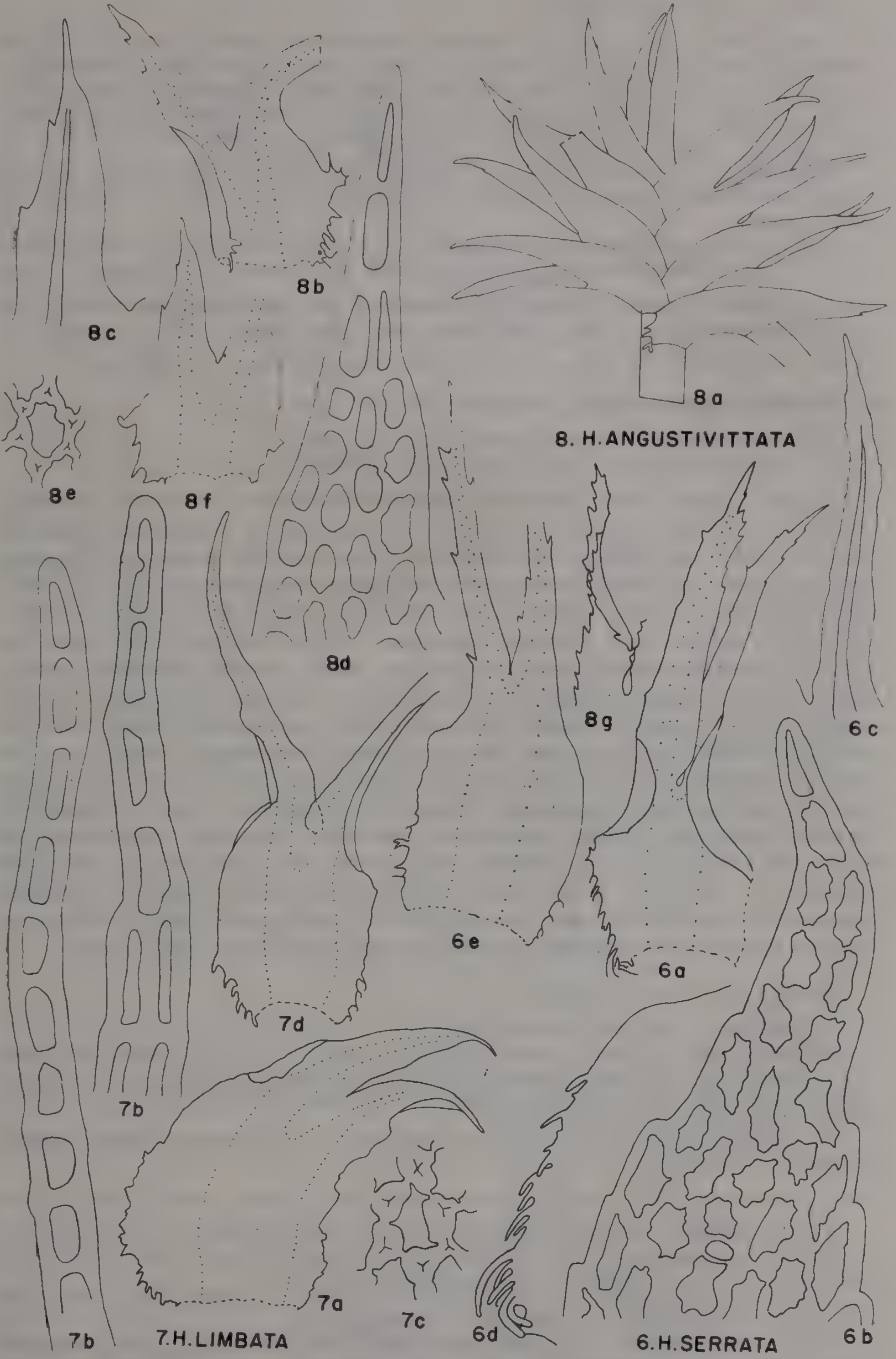
Schisma limbatum Stephani, Spec. Hep. **4**: 14. 1909.
Schisma wallisiana Stephani, Spec. Hep. **4**: 18. 1909.
Herberta vulcanicola Herzog, Revue Bryol. Lichénol. 11: 25. *f. 5 e–i.* 1938.

Plants of medium size, bright rose-red to purplish or light brown, in tufts; stems robust 10–15 im long, with leaves 3–4 mm wide, simple, rarely branched. Line of the leaf insertion transverse. Leaves irregularly spreading, the bases imbricate, 3–4 mm long, 1–1.5 mm wide below, bifid to one-half of their length or less; segments triangular from a broad base, tapering to a long-acuminate apex of elongate cells, curved, the margins entire, the vitta about half the width of the base of the segment; lamina broadly ovate, the margins toothed and appendiculate below, the vitta broad, bifurcate some distance below the sinus; leaf-cells very thick-walled with thin-walled pits, the cuticle rough. Underleaves similar to the leaves, the segments less curved. Male and female inflorescences and sporophytes not seen. Fig. 7, a–d.

FIG. 6. *Herberta serrata.* 6 a. Leaf, × 18. 6 b. Cells of the tip of a leaf segment, × 350. 6 c. Segment of a leaf (*S. subserrata*), × 33. 6 d. Leaf base, × 50. 6 e. Underleaf, × 18.

FIG. 7. *H. limbata.* 7 a. Leaf, × 18. 7 b. Cells of the tips of leaf segments, × 350. 7 c. Cell from the leaf segment, × 350. 7 d. Underleaf, × 18.

FIG. 8. *H. angustivittata.* 8 a. Stem, dorsal view, × 18. 8 b. Leaf, × 18. 8 c. Leaf segment, × 33. 8 d. Cells of the tip of a leaf segment, × 350. 8 e. Cells from the dorsal base of a leaf, × 350. 8 f. Underleaf, × 18. 8 g. Segment from the mouth of the perianth, × 18.


8c
8b
8a
8. H. ANGUSTIVITTATA
8e
8f
8d
8g
6c
7b
7d
6e
6a
7b
7a
7c
6d
6b
7b
7. H. LIMBATA
6. H. SERRATA

Habitat: On trees in forests.

COSTA RICA: slope Volcán de Turrialba, 2000-2400 m, *Standley 35297*, type of *H. vulcanicola*; *Standley 35316* (Hb. Herzog). Heredia: Yerba Buena, 2000 m, *Standley & Valerio 50099* (Hb. Herzog); Cerros de Zurqui, 2000–2400 m, *Standley & Valerio 50330, 50574, 50666, 50714* (Hb. Herzog). Cartago: La Estrella, *Standley 39245b* (Hb. Herzog); Pejivalle, 900 m, *Standley & Valerio 47024* (Hb. Herzog); La Palma, 1500 m, *Valerio 31* (Hb. Herzog); Volcán Barba, 2800 m, *Valerio 26* (Hb. Herzog).

COLOMBIA: s.l., *Wallis*, type of *S. wallisiana* (G); Páramo El Bogueron, 3500 m, *C. Troll 2150* (Hb. Herzog). El Cauca: San Antonio 2400–2700 m, *Pennell & Killip 11864* (Hb. Herzog).

ECUADOR: Mt. Altar, *H. Meyer*, (type G); El Altar, páramo, 4000 m, *H. Meyer 5462*, (Hb. Herzog); Tungurahua, near Las Torres, 3500 m, *Asplund* (Hb. Herzog).

The species is readily recognized because of the long-acuminate tips of the leaves and underleaves. They are fragile and easily broken, but can usually be seen at the apex of the stem. The tip cells are much longer than broad.

8. **Herberta angustivittata** (Stephani) Fulford, comb. nov.

Schisma angustivittata Stephani, Spec. Hep. 4: 12. 1909.
Schisma simplex Stephani, Spec. Hep. 6: 362. 1922.

Plants of small to medium size, dark greenish-brown to brown, in tufts; leafy stems to 5 cm long, to 1 mm wide, often beginning as small-leaved branches from a caudex or rhizone with scale-like leaves, rarely branched. Rhizoids abundant, from the scale leaves of the flagelliform branches and the rhizome. Leaves imbricate, erect-spreading, 2–3 mm long, to 1.5 mm wide, short, rectangular, bifid to one-half; the segments triangular from a wide base, tapering to the acute or short-acuminate apex, the margins entire or with occasional coarse teeth, the vitta less than one-fourth the width of the base of the segment base, ending below the apex; lamina subrectangular, the margins scarcely convex, with coarse teeth near the base, the vitta strong, bifurcate a little above the base, the basal cells of the segments and of the dorsal base with thick irregular walls, the pits and trigones scarcely evident. Plants dioicous. Female inflorescence terminal, with one subfloral innovation, this often becoming floraliferous, the bracts and bracteoles in three to six series, similar, and similar to the leaves and underleaves, the inner series larger, the margins coarsely toothed. Perianth (immature) 3-parted for half the length, the divisions bilobed, the segments coarsely toothed. Male inflorescence and sporophyte not seen. Fig. 8, a–g.

Habitat: On trees in forests.

VENEZUELA: Caracas, *Burchell* (NY).

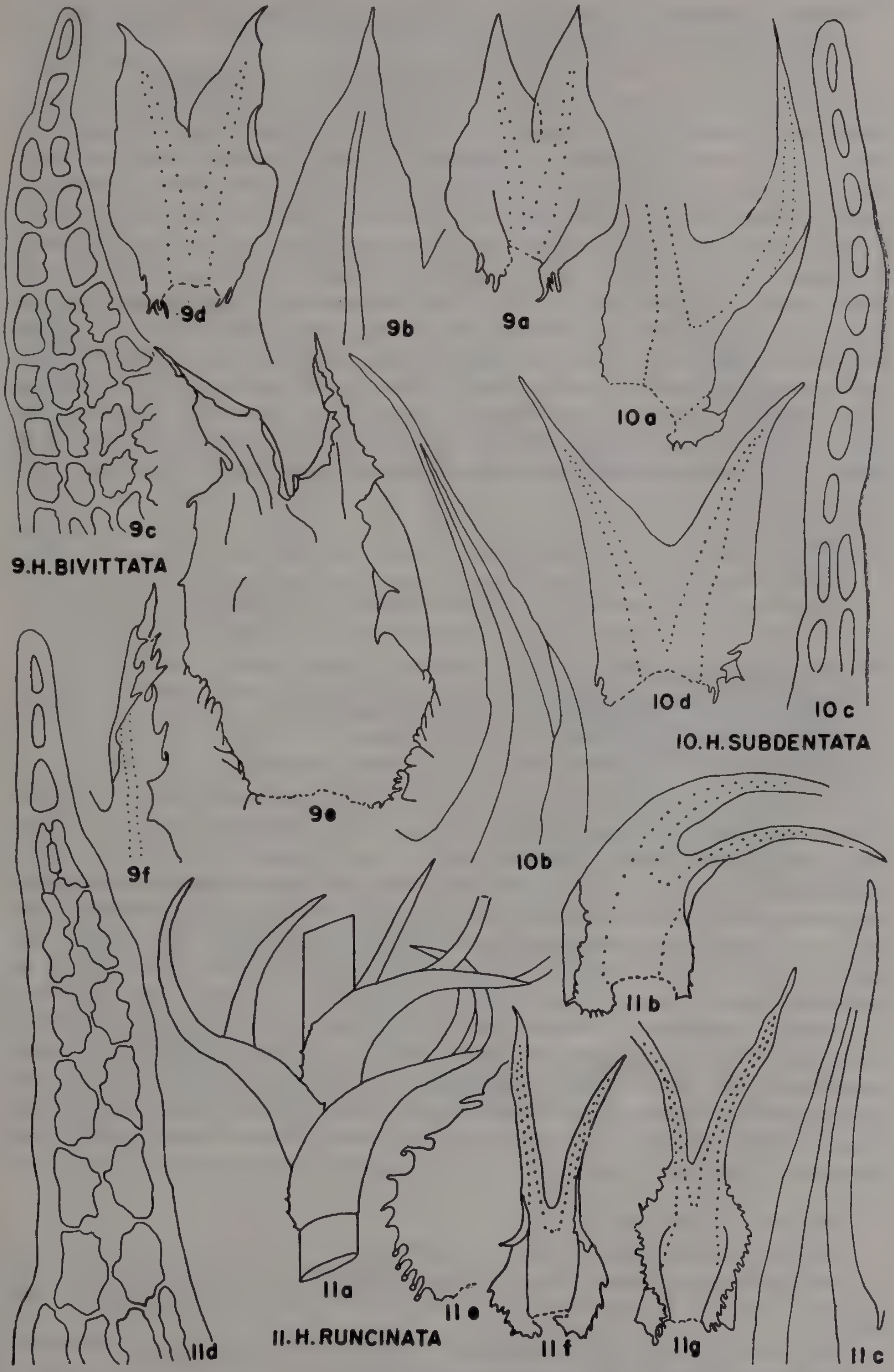
BRAZIL: Rio de Janeiro, *Glaziou 7133*, type, *Glaziou 1457* (G); Paraná, Mt. Alegre, 700 m, *Dusén* (type G); Campo Grande, Alto da Serra, *Kuhlmann 325* (as *S. simplex* f. *parvifolia*), *Hoehne* (Hb. Herzog); Santos, *Meyer* (Hb. Herzog), Santos, *Mosén* (G); S. Paulo, *Mosén 256*, type of *S. simplex* (G-1556).

The species has also been reported in the literature from Bolivia (Herzog, 1934b) and Brazil (Herzog 1925a).

FIG. 9. *Herberta bivittata.* 9 a. Leaf, × 18. 9 b. Leaf segment, × 33. 9 c. Cells of the tip of a leaf segment, × 350. 9 d. Underleaf, × 18. 9 e. Female bract of the innermost series, × 18. 9 f. Segment of the perianth mouth, × 18.

FIG. 10. *H. subdentata.* 1 a. Leaf, × 18. 10 b. Leaf segment, × 33. 10 c. Cells of the tip of a leaf segment, × 350. 10 d. Underleaf, × 18.

FIG. 11. *H. runcinata.* 11 a. Stem, dorsal view, × 18. 11 b. Leaf, × 18. 11 c. Leaf segment, × 33. 11 d. Cells from the tip of a leaf segment, × 350. 11 e. Leaf base, × 50. 11 f. Underleaf, × 18. 11 g. Male bract, × 18.


9d
9b
9a
10a
9c
10d
10c
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9f
10b
11b
11a
11e
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11d
11c

9. H. BIVITTATA

10. H. SUBDENTATA

11. H. RUNCINATA

9. **Herberta bivittata** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 343. 1885.
Schisma bivittatum (Spruce) Stephani, Spec. Hep. **4**: 11. 1909.

Plants of medium size, julaceous, greenish-brown tinged with red, in tufts; leafy stems coarse, 5 cm or more long, with leaves to 2 mm wide (when dry), occasionally branched, the branches leafy. Line of leaf insertion transverse. Leaves erect-spreading, imbricate, symmetric, concave, broadly ovate, subquadrate, 2.5–3 mm long, 2 mm wide, bifid to one-third or one-half of their length; segments short, broadly triangular-acute to short-acuminate, the margins entire or with an occasional coarse tooth, the vitta one-eighth the width of the base of the segment, ending well below the apex; lamina broad, the margins strongly convex from a narrow base, entire, or with an occasional appendage near the base, the vitta bifurcate from the base. Underleaves like the leaves. Plants dioicous. Female inflorescence terminal on the stem, the bracts and bracteoles in four to six series, like the leaves but with more marginal teeth, the innermost series largest, the segments and margins incised with coarse teeth, the base with many cilia and appendages. Perianth (immature) 3-parted to one-half of its length, the divisions bilobed, the segments incised. Male inflorescence and sporophyte not seen. Fig. 9, a–f.

Habitat: On trees in forests.

PERU: Campana, 1200 m, *Spruce, Hep. Spruc.*, type (isotypes NY, G).

The species is also reported in the literature from Costa Rica (Herzog, 1938a, = *H. limbata*).

10. **Herberta subdentata** (Stephani) Fulford, comb. nov.
Schisma subdentatum Stephani, Trans. Linn. Soc. Bot. II. **6**: 99. 1901.
Schisma striolatum Stephani, Spec. Hep. **4**: 13. 1909.
Schisma karstenii Stephani Spec. Hep. **4**: 14. 1909.
Herberta durandii var. *dissecta* Herzog, Revue Bryol. Lichénol. **11**: 25. 1938.

Plants of small to medium size, yellowish to reddish-brown or black, in tufts; leafy stems 3 to 10 cm long, with leaves 1 mm wide, irregularly branched, sometimes pinnate; the branches lateral, leafy, of the *Frullania* type with the lanceolate half-leaf dorsal, or ventral and usually flagelliform. Rhizoids from the scale-like leaves of the flagelliform branches. Leaves imbricate, erect-spreading, tending to be falcate, subrectangular, 2–3 mm long, 1.0–1.5 mm wide, bifid to one-half of their length; segments triangular from a broad base, tapering to the acuminate apex of three to eight cells, the margins entire, the vitta one-fourth or less of the width of the base of the segment, ending below the apex, the sinus V-shaped, broad; lamina broadly ovate, the margins convex, with a few coarse appendages, the vitta bifurcate just above the base; leaf-cells with very large trigones and thickenings and thin-walled pits, the cuticle roughened. Underleaves slightly smaller, not so wide as the leaves, the segments usually erect spreading. Male and female inflorescences and sporophyte not seen. Fig. 10 a–d.

Habitat: On trees and rocks.

MEXICO: Orizaba, *Karsten*, type of *S. karstenii* (G).

COSTA RICA: Heredia: Cerros de Zurqui, 2000–2400 m, *Standley & Valerio 50338*, type of *H. durandii* var. *dissecta* (Hb. Herzog); Volcán Barba, 3000 m, *Valerio 1, 5* (Hb. Herzog).

COLOMBIA: Antigua: Páramo de Sonson, 10,000 ft, *G. Wallis*, type of *S. striolatum* (G).

BRITISH GUIANA: Mt. Roraima, *Quelch* (type G).

BRAZIL: "Roraima," *Ule 650* (G).

BOLIVIA: Unduavi, *Pearce* (G); Cejawald, *C. Troll* (Hb. Herzog); near Tablas, 3400 m, *Herzog 2850* (Hb. Herzog); Abia de San Benito, 3900 m, *Herzog* (Hb. Herzog).

11. Herberta runcinata (Taylor) Herzog in Skottsberg, Nat. Hist. Juan Fernandez Easter Is. **2**: 728. 1942.

Sendtnera runcinata T. Taylor, London Jour. Bot. **5**: 372. 1846.
Schisma reicheanum Stephani, Spec. Hep. **4**: 20. 1909.
Schisma runcinata (Taylor) Stephani, Spec. Hep. **4**: 21. 1909.
Schisma ferrugineum Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 72. *f. 28 a.* 1911.

Plants of small to medium size, light to dark brown, often reddish, in tufts or scattered among other bryophytes; leafy stems 3–5 cm long, with leaves to 2 mm wide (when dry), rarely branched. Line of leaf insertion transverse. Leaves erect-spreading, imbricate below, asymmetric, 3–5 mm long, 1–2 mm wide, bifid to the middle or below; segments long, lanceolate, the dorsal segment the larger, the tips acuminate by a few hyaline cells, the vitta often scarcely conspicuous in light-colored leaves, ending below the apex, the margins entire or crenulate; lamina ovate, the margins convex, with few to many appendages in the lower half, the vitta bifurcating some distance below the sinus; leaf cells with very thick walls, large trigones, and large thin-walled pits, the cuticle rough, often warty. Underleaves similar to the leaves, symmetric, the segments more or less erect. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem, the bracts and bracteoles like the leaves, pouched. Female inflorescence and sporophyte not seen. Fig. 11, a–g.

Habitat: On trees, tree bases, logs, rarely on rocks or soil, in forests.

CHILE—PATAGONIA: Corral: Quitaluto, *Hosseus 625a, 686a,* (as f. *incompleta depauperata*), *679d* (as f. *minor* & f. *incompleta*) (Hb. Herzog); Lago Pillaifa, *Schwabe 13* (Hb. Herzog); Chaihuin-Colun, 500 m, *Schwabe 26f, 32b* (Hb. Herzog); Chiloe, *Jung 2435* (Hb. Herzog); Istmo de Ofqui, *Grosse* 2 p.p. (Hb. Herzog); Pto Puyuhuapi, *Schwabe 53 p.p.* (Hb. Herzog); Pto Varas, *Dusén 446* (NY); Río Palena, *Reiche,* type of *S. reicheanum* (G-5420); Chiloe, *Reed* (NY), *Cuming 1447* (isotype, NY); Guaitecas I., *Dusén 97a* (NY); Pto Vasso, *Dusén* (NY); Newton I., *Dusén* (NY); Desolation I., *Dusén* (G); Magellan Straits (Voy, Albatross) (NY); w and s Patagonia, *Skottsberg,* type of *S. ferrugineum* (G). Juan Fernandez: Masefuera, Las Torres, *C. & I. Skottsberg 1375* (Hb. Herzog).

The following taxa which belong to the genus *Herberta* have not been available for study:
Schisma orizabense Gottsche, 1863. Mexico.
Schisma elliottii Spruce, 1895. Dominica.
Herberta pumila Jack & Stephani, 1895. Argentina.
Schisma durandii Stephani, 1901. Roraima.
Schisma uleanum Stephani, 1905. Ule.
Schisma oblongifolium Stephani, 1909. Brazil.
Schisma peruviense Stephani, 1909. Peru.
Schisma latevittatum Stephani, ms. *Icones Hep., Schisma* no. 32.
Sendtnera chilense De Notaris, 1857. Chile.

LEPIDOZIACEAE H. Arnell in O. R. Holmberg, Scand. Fl. **2**: 194. 1928. emend. Fulford, Brittonia **15**: 000. 1963.

Sporeling protonema of the *Nardia* type. Leafy stems erect, radially symmetric to prostrate and dorsiventral, in some from a creeping caudex; branches both terminal (of the *Frullania, Microlepidozia,* and *Acromastigum* types), and ventral-intercalary in the axils of the underleaves, leafy, flagelliform or as stolons; stems in transverse section undifferentiated or with a cortical layer of 12 (sometimes 24, 18, 15, 9, or 6) larger cells. Rhizoids from the scale-leaves of the flagelliform branches, more rarely from the underleaves or the base of a short female branch. Leaf insertion transverse, or oblique with the leaves incubous or succubous. Leaves subentire, serrate above, or bifid, trifid, quadrifid, to many-parted, keeled in a few genera. Underleaves as large as the leaves and similar, or smaller and of different form. Male inflorescence terminal on the stem or a long branch, becoming intercalary, or on a short ventral-intercalary sexual branch; antheridia only in the axils of the bracts. Female inflorescence terminal on the stem, a long leafy branch, a flagelliform branch, or a short ventral-intercalary sexual branch; bracts and bracteoles in three or four series, different from the leaves and underleaves; archegonia about ten. Perianth three-keeled at least above, the mouth contracted, entire, or variously serrulate, dentate, or ciliate. Shoot/sporophyte relationship a shoot-calyptra, with unfertilized archegonia on the surface, at least below the middle. Sporophyte foot inverted-cone-shaped; seta of 16 or 8 large cells surrounding the inner, large to somewhat smaller cells; capsule wall in two to five layers, the cells with characteristic thickening bands.

Type genus: *Lepidozia* Dumortier.

Bazzania S. F. Gray, Nat. Arr. Br. Pl. **1**: 704. 1821.

Pleuroschisma Dumortier, Syll. Jungerm. 68. 1831.
Herpetium C. G. Nees, Nat. Eur. Leberm. 1: 96. 1833.
Mastigobryum Nees, Lindenberg & Gottsche, Syn. Hep. 214. 1845.

Plants in tufts or depressed mats, bright green, olive-green, golden-yellow, reddish, or brown; stems filiform to robust, the lateral branches of the *Frullania* type forming apparent dichotomies, subtended by an ovate, acute dorsal half-leaf; ventral branches intercalary, in the axils of underleaves, flagelliform, long, filiform with scale-like leaves; stem in transverse section little differentiated; rhizoids colorless, from the scales of the flagelliform branches, the lower portions of the female bracts, or rarely from the underleaves. Line of leaf insertion oblique, straight to strongly curved in its upper part, in some becoming hook-formed. Leaves incubous, alternate (rarely opposite), asymmetric, ovate to lanceolate, the dorsal base convex to cordate, the ventral base often more or less auricled, the apex truncate, 2–3-toothed (rarely 4-toothed), in a few species undivided; leaf-margins entire, rarely serrate to spinose-dentate, sometimes ciliate or appendiculate at the ventral base; leaf-cells quadrate to hexagonal, the walls thin or thickened and containing pits; trigones very small to large, often coalesced; a vitta of larger cells present in some species; cuticle smooth to verruculose. Underleaves quadrate, elongate to ovate, sometimes cordate at the base, the line of attachment transverse or recurved, in some connate with leaves on one or both sides, the apex rounded-entire to 2–4-toothed or -lobed, or variously incised, the margins entire, crenulate, spinose-dentate to ciliate. Plants dioicous, the sexual branches short, ventral, intercalary, axillary; male branches catkin-like, the bracts ovate, concave, bilobed to bispinose, the bracteoles slightly smaller, plane; antheridia one or two; female branches solitary, the bracts and bracteoles in three or four series, unlike the leaves, orbicular-ovate to ovate-lanceolate. Perianth to 6 cm long, ovoid-cylindric, terete below, trigonous and of a single layer of cells above, often with additional folds, the mouth of three ciliate to dentate lobes, usually contracted. Sporophyte capsule oblong-ovoid, the wall usually of five layers, the outermost layer with brown thickenings as knots along the vertical walls, the innermost layer with brown thickenings as half-rings or bands on the inner tangential walls; capsule-stalk with an outer layer of 16 large cells surrounding many smaller cells; spores small, brown; elaters long, slender, bispiral. Sporeling of the *Nardia* type. Vegetative reproduction by means of leafy shoots from cylindric protonemata from cells of ordinary or caducous leaves and underleaves.

Type species: *Jungermannia trilobata.*

This large genus is most abundant in tropical and subtropical regions, with a few species extending northward into the Northern Hemisphere, or southward from the tropics. It is easily recognized in the field because of the apparent dichotomies of the stem, the ventral flagelliform branches, the incubous leaf arrangement, the usually three-toothed leaves, and the conspicuous underleaves. Unfortunately, it is much more difficult to recognize many of the species, for most of them are exceedingly variable, as Spruce (1885) has pointed out. This variation is more than habitat modification, and is often so extreme among the plants of different areas, or even between male and female plants, that the limits of certain taxa have been established on a more or less arbitrary basis.

The genus appears to be an old one, since there are two easily recognized subgenera and six sections, and the distribution patterns of groups of species, or of individual species, are often localized or discontinuous. A number of species have an Antarctic distribution.

Key to the Species

A. Leaves predominantly 2-toothed. (subg. *Bidentatae*)
- Stems coarse-thread-like to delicate-filiform, slender; in green to dark green mats.
  - Leaves caducous, vittate; underleaves small, distant, scarcely divided. 7. *B. gracilis.*
  - Leaves persistent, often reduced or deflexed.
    - Leaves with a vitta of larger thin-walled cells with conspicuous trigones.
      - Underleaves scarcely as broad as the stem, the apex faintly lobed or toothed. 7. *B. gracilis.*
      - Underleaves mostly broader than the stem, irregularly and coarsely incised or toothed; teeth of the leaves with crenulate margins; vitta not very conspicuous. 2. *B. phyllobola.*
    - Leaves without a well-marked vitta.
      - Cells of the apical portion of the leaf mostly (18)24–36 μ, the trigones very large and rounded. 6. *B. roraimensis.*
      - Cells of the apical portion of the leaf mostly 18–24 μ, the trigones small, conspicuous. 4. *B. cuneistipula.*

Stems not filiform, larger, the leaves spreading.

Plants with leaves narrow-elongate to elongate-ovate.

Margins of the teeth entire; underleaves subquadrate, distant to imbricate, the apical margins only faintly 2–4-lobed. 1. *B. bidens.*

Margins of the teeth more or less crenulate; underleaves with variously and deeply incised, toothed, and lobed margins, mostly broader than the stem. 2. *B. phyllobola.*

Plants with leaves asymmetrically ovate.

Leaves with a vitta.

Underleaves mostly broader than the stem, with variously and deeply incised, toothed, and lobed margins. 2. *B. phyllobola.*

Underleaves not broader than the stem, the lateral margins undivided.

Ventral margin of the leaf strongly convex, arcuate, the teeth broad, the acroscopic tooth usually the larger; cells of the apical portion with conspicuous trigones, often coalesced. 3. *B. herminieri.*

Ventral margin of the leaf scarcely convex, the teeth equal or nearly so; trigones small, rarely conspicuous. 6. *B. gracilis.*

Leaves without a vitta; teeth short, the sinus broad, lunulate.

Cells of the apical portion of the leaf (18)24–36 μ, the trigones very large and rounded. 5. *B. roraimensis.*

Cells of the apical portion of the leaf 18–24 μ, the trigones small, conspicuous, often coalesced. 4. *B. cuneistipula.*

A. Leaves predominantly 3-toothed, occasionally only faintly so, or rarely entire. (subg. *Tridentatae*)

B. Leaves with a conspicuous vitta (sect. 5, *Vittatae*).

Plants with underleaves chlorophyllose throughout, subquadrate to ovate in outline, the lateral and apical margins variously lobed, toothed, and incised. 52. *B. spruceana.*

Plants with underleaves hyaline at least in the upper part, more or less regularly 4-toothed, the lateral margins undivided, entire.

Cuticle of the leaves and underleaves abundantly minutely punctate; teeth of the leaves well developed, four to six cells long; underleaves hyaline throughout, often 2–4-lobed above. 53. *B. tayloriana.*

Cuticle of the leaves and underleaves smooth to verruculose; teeth of the leaves one or two cells long, often recurved, sometimes absent; underleaves chlorophyllose in the lower part.

Underleaves distant, one-third to one-half divided into four slender, acute, often spreading teeth. 54. *B. nitida.*

Underleaves often approximate to imbricate, broader than the stem, undivided, emarginate or with two to four obtuse lobes or teeth (some underleaves of a stem may have four acute teeth). 55. *B. heterostipa.*

B. Leaves without a vitta (in rare instances there is a suggestion of one).

C. Underleaves connate at the base with one or both leaves; leaf-margins entire, inconspicuously serrulate to strongly dentate (sect. 2, *Connatae*).

Underleaves connate by a few cells (often one or two) with one leaf only (always on the same side of the stem).

Underleaves chlorophyllose throughout.

Underleaves entire or nearly so. 32. *B. fendleri.*

Underleaves variously 3-toothed, the margins strongly serrate and spinose 37. *B. cubensis.*

Underleaves with a border of hyaline cells.

Leaves conspicuously 3-toothed, the margins strongly serrate and spinose. 36. *B. armatistipula.*

Leaves conspicuously 3-toothed, the margins obscurely serrate 35. *B. eggersiana.*

Leaves inconspicuously 3-toothed to truncate- undulate, the margins serrate and spinose. 34. *B. pycnophylla.*

Leaves mostly rounded-entire, the apical margins only serrate. 33. *B. schwaneckiana.*

Underleaves connate with a pair of leaves.

Plants of medium size to large, 2–3.5 mm broad, usually long, green becoming brownish, smaller plants light green to greenish-brown; leaves usually long, ascendent, becoming recurved to falcate from a broad base, the ventral margin always concave, the teeth long, slender, the apical margin serrate-dentate; cells of the apical portion mostly 22–24 μ long; underleaves with a hyaline border, variously incised and lobed, the margin coarsely dentate to serrate. 38. *B. peruviana.*

Plants of medium size to small, to 2 mm broad; the leaves spreading to ascendent, the ventral margin straight or convex, the teeth short, slender, short-spinose or obscure, the apical margin more or less serrate.

Plants small, delicate, light green rarely becoming darker, the leaves spreading, with a suggestion of a vitta, the ventral margin convex; underleaves incised, strongly serrate-dentate, hyaline to a third or more of their length. [forms of] 38. *B. peruviana.*

Plants more or less brown, often strongly so; leaves ascendent, the ventral margin straight or nearly so, the teeth short to obscure, the apical margins more or less serrate, most cells of the apical region 27 μ or more in length; underleaves mostly undivided (or with occasional broad, shallow lobes or teeth), the margin entire or with a few serrations; hyaline cells absent or a few scattered along the margin, or more forming a narrow border. 39. *B. skottsbergii.*

C. Underleaves free from the leaves.

D. Underleaves divided to the middle into long lobes or teeth (sect. 3, *Fissistipulae*). Leaves sharply 3-toothed; trigones very large, rounded; leaf margins coarsely crenulate. 40. *B. chimantensis.*

D. Underleaves more or less entire or divided to not more than one-third their length into lobes or teeth.

E. Leaves with a conspicuous, usually appendiculate ventral auricle; underleaves large, cordate, attached in a recurved line; the line of the leaf insertion curved in the upper part, the dorsal end bent downward forming a hook. (sect. 4, *Appendiculatae*).

Plants with leaf apices broad, rounded-entire, subentire or with three, short broad lobes or teeth; leaves spreading.

Leaves rounded-entire, the trigones large, knot-like. 50. *B. placophylla.*

Leaves subentire or with three low, broad teeth; cell-walls thin, the trigones smaller. 49. *B. canelensis.*

Plants with the leaf apices conspicuously 3-toothed.

Ventral auricles of the leaves and the margins and auricles of the underleaves undulate and serrate to dentate; cuticle rough. 41. *B. schlimiana.*

Ventral auricles of the leaves and the auricles of the underleaves not as above.

Plants very large, the leaves falcate; underleaves with one or more very long sharp teeth at a right angle to the lateral margin. 48. *B. acanthostipa.*

Plants of medium size to large or robust; underleaves with short marginal teeth or lobes, or entire, or obscurely serrate.

Auricles of the underleaves large, with coarse teeth and/or deeply incised, and with several conspicuous appendages; ventral auricles of the leaves similar.

Plants robust; underleaves large, the margin obscurely serrate, the appendages of the auricles numerous. 51. *B. macrostipula.*

Plants of medium size to large; underleaves variously lobed, toothed or crenulate.

Leaves short, narrowed from a very broad base to the obliquely truncate apex; cells 24–27 μ, the trigones small. 45. *B. boliviana.*

Leaves long, becoming falcate; cells 18 μ, the trigones large, knot-like. [some tropical forms of] 42. *B. falcata.*

Auricles of the underleaves and the ventral base of the leaf variously toothed or lobed or entire, but only rarely with one or more appendages.

Underleaves (at least some) conspicuously 4-lobed or -toothed; ventral auricles of the leaves more or less conspicuous, with occasional teeth or spines. 47. *B. teretiuscula.*

Underleaves never deeply 4-lobed; ventral auricles of the leaves large or small.
Underleaves usually large, more or less quadrate, the margin often angled and incised, the auricles more or less toothed; cells 18 μ, the cavities stellate; trigones very large, knotlike; leaflets of the flagelliform branches large. 42. *B. falcata.*
Underleaves large, usually entire, the apex undulate or with an occasional tooth; cell cavities angular-rounded; trigones large to medium size.
Leaves not conspicuously narrowed to the apex; ventral appendages rare or absent; teeth broad, the cells mostly 20 μ, with conspicuous trigones. 43. *B. hookeri.*
Leaves narrowed to the apex; teeth sharp, pointed.
Leaves spreading, the cells 18–20 μ; leaflets of the flagelliform branches scalelike. 46. *B. liebmanniana.*
Leaves more or less falcate, the cells large, 24–36 μ; leaflets of the flagelliform branches large. 44. *B. robusta.*

E. Auricles of the leaves, if conspicuous, never appendiculate; underleaves attached in a straight or rarely a curved line; line of the leaf insertion curved to hook-form. (sect. 1, *Grandistipulae*).
Underleaves in part of hyaline cells which often form a conspicuous border.
Leaf margins serrate throughout; leaves mostly 3-toothed. 10. *B. serrata.*
Leaf margins not serrate.
Leaf cells thin-walled; trigones absent or minute; underleaves hyaline except for a small internal area at the base. 7. *B. affinis.*
Leaf cells thin-walled; trigones small to conspicuous, often with bulging sides, the cell lumina angular-rounded.
Underleaves longer than broad, one-third to three-fourths hyaline, the apex variously incised or spinose, the lateral margins scarcely bulging; leaves elongate, the teeth usually coarse, the cells mostly 36 μ. [forms of] 8. *B. pallide-virens.*
Underleaves subquadrate-rounded, the hyaline border continuous to the base.
Hyaline cells thin-walled, without trigones; chlorophyllose cells of the interior with conspicuous trigones. 9. *B. stolonifera.*
Cell walls and trigones of the hyaline and chlorophyllose areas similar.
Hyaline border narrow, of one to four rows of cells; teeth of the leaves usually ending in a 1-celled point; cuticle coarsely verruculose. 11. *B. chilensis.*
Hyaline border variable, narrow or including half the underleaf, or absent; teeth of the leaves usually ending in a 2-celled point; cuticle faintly verruculose. 12. *B. taleana.*
Underleaves chlorophyllose throughout (rarely with a few scattered hyaline cells on the margin).
Underleaves variously toothed or deeply lobed to incised, spinose or dentate in the apical portion and often on the lateral margins.
Underleaves spinose-dentate and ciliate to the base. 13. *B. denticulata.*
Underleaves coarsely toothed, broad-lobed, or irregularly incised, never ciliate.
Underleaves conspicuously 4-lobed or variously incised and with a few spinose teeth in the upper part.
Underleaves twice as long as broad, with four long, rounded lobes. 27. *B. elongata.*
Underleaves approximately as broad as long.
Plants very robust, green or brown; leaves with large teeth; underleaves very large, subquadrate and strongly cordate.
Plants olive-green to brown; leaf cells with very large triradiate trigones; margins of the underleaves never hyaline. 28. *B. crassidentata.*

Plants green; leaf cells with thin walls and small trigones; margins of the underleaves broadly lobed and undulate, with scattered hyaline cells on the top. 18. *B. chimborazensis.*

Plants large to small; underleaves not strongly cordate, mostly broadest above the middle; hyaline cells absent.

Underleaves deeply 4-lobed (at least those subtending the flagelliform branches); leaf cells mostly 20–24 μ. 14. *B. quadricrenata.*

Underleaves variously and irregularly incised-lobed above and on the margins; leaf cells mostly 24–36 μ, the trigones large, knot-like. 15. *B. aurescens.*

Underleaves mostly shortly incised or with only a few short incurved teeth on the apical margin.

Leaf cells mostly 27–48 μ in length.

Some of the underleaves hyaline above or throughout; teeth of the leaves long and sharp (rarely short). 8. *B. pallide-virens.*

Underleaves never hyaline.

Underleaves twice as long as broad, conspicuously 4-lobed 27. *B. elongata.*

Underleaves about as long as broad, faintly lobed between two incurved teeth. 26. *B. sublonga.*

Leaf cells mostly 18–24 μ in the apical part of the leaf.

Plants of medium size to large; leaves spreading, cells 20–24 μ, underleaves broadest above the middle. 16. *B. glaziovii.*

Plants small to thread-like; underleaves quadrate to orbicular.

Leaves ascendent, vittate; underleaves appressed; cuticle coarsely verruculose. 52. *B. spruceana.*

Leaves spreading to falcate and decurved, narrowed to the obliquely truncate apex; underleaves squarrose; cuticle smooth to faintly verruculose. 23. *B. tricrenata.*

Underleaves with entire margins, or the apical margin retuse, or with three or four broad shallow lobes and an occasional short spine.

Underleaves subquadrate.

Plants large, green; underleaves cordate at the base.

Lateral margins of the underleaves entire, convex, recurved, the apex retuse. 19. *B. acuminata.*

Lateral margins of the underleaves plane, often undulate or sinuate, convex.

Apical margin of underleaves lobed, incised, and with scattered spines and teeth and occasional hyaline cells; lateral margins lobed. 18. *B. chimborazensis.*

Apical margin of underleaves entire or undulate with four broad lobes (rarely with a spine).

Leaves strongly arcuate from a conspicuous rectangular ventral appendage; underleaves broadest at the base. 31. *B. arcuata.*

Leaves spreading or only slightly ascendent or decurved, a ventral auricle scarcely developed. 17. *B. breuteliana.*

Plants large, yellow-brown to deep red-brown.

Underleaves deeply 4-lobed. twice as long as broad. 27. *B. elongata.*

Underleaves never deeply 4-lobed.

Underleaves crenate-undulate, not cordate at the base; leaves long, the teeth very long and coarse; cells of the apical portion large, 45 × 27 μ, the walls uniform, very thick and with small pits. 28. *B. crassidentata.*

Underleaves cordate-auriculate, attached in a recurved line (see sect. *Appendiculatae*).

Plants smaller, not as above.

Teeth of the leaves very small to obscure; cells of the apical region mostly quadrate, trigones small; underleaves distant, the margins entire. 20. *B. diversicuspis.*

Teeth of the leaves well developed.
Underleaves small, rounded, distant; leaf apices broad, transversely truncate; trigones conspicuous 21. *B. tricuspidata.*
Underleaves approximate to imbricate, broader than the stem.
Leaf cells mostly 30–36 μ, the trigones very large, knot-like; leaves spreading to falcate, the teeth often coarse, sharp; plants yellow-brown to reddish-brown. 25. *B. longa.*
Leaf cells mostly less than 28 μ.
Underleaves squarrose-spreading, never hyaline; plants olive to brownish or becoming reddish; leaves spreading to ascendent or recurved; cells 20–26 × 22μ. 23. *B. tricrenata.*
Underleaves not squarrose.
Leaves spreading or rarely ascendent; cells 16–20 × 18 μ, the walls thin, the trigones inconspicuous; underleaves often hyaline on the margins; plants green to greenish-brown. 12. *B. taleana.*
Leaves ascendent, obliquely truncate; cells mostly 24 μ (rarely to 30 μ), the trigones small but conspicuous. 22. *B. longistipula.*
Underleaves longer than broad, rectangular in outline, the bases not cordate.
Leaves ascendent, obliquely truncate; cells 24 μ (rarely to 30 μ), the trigones small, conspicuous; plants green to yellow-brown. 22. *B. longistipula.*
Leaves spreading, sometimes falcate.
Underleaves entire, usually faintly lobed at the apex.
Leaves spreading, long, the teeth of medium size; leaf cells mostly 24 μ, the trigones small but conspicuous. 24. *B. latidens.*
Leaves spreading to falcate, the teeth often coarse, often ending in a spine; leaf cells 30–36 μ, with very large trigones. 25. *B. longa.*
Underleaves with a few spines, teeth, or lobes on the apical margin.
Underleaves deeply 4-lobed. 27. *B. elongata.*
Underleaves not deeply 4-lobed.
Plants green becoming brownish; leaf cells mostly 30–36 μ, with large knot-like trigones. 8. *B. pallide-virens.*
Plants deep brown becoming blackish; leaf cells mostly 40–45 μ, the walls very thick from coalesced trigones. 28. *B. crassidentata.*
Underleaves oval to reniform, rounded to cordate or auriculate at the base.
Underleaves reniform, cordate to auriculate at the base.
Underleaves inflated, the yellow-brown margins appressed to the stem; leaf cells mostly 18–22 μ. 29. *B. jamaicensis.*
Underleaves plane, the margins rarely pigmented; cells of the apical part elongated and with knot-like intermediate thickenings on the walls; leaf cells mostly 24 μ or more in diameter. 30. *B. wrightii.*
Underleaves oval, the base rounded to cordate.
Apical margin of the underleaves retuse, the lateral margins recurved. 19. *B. acuminata.*
Apical margin of the underleaves entire or sinuate but not retuse.
Leaves strongly arcuate, the ventral margin deeply concave from a large rectangular ventral auricle. 31. *B. arcuata.*
Leaves spreading to arcuate but not as above.
Cells of the apical part of the underleaves elongate and with intermediate thickenings on the walls; leaf cells mostly 24 μ or more. 30. *B. wrightii.*
Cells of the apical part of the underleaf quadrate (the walls often somewhat thickened and pigmented); leaf cells mostly 18–22 μ. 29. *B. jamaicensis.*

SUBGENUS BIDENTATAE

The outstanding character of this subgenus is the bidentate apices of the leaves. Occasional three-toothed leaves may occur more or less frequently on some stems and most of the species appear to be related to species in the subgenus *Tridentatae.*

The line of leaf insertion is oblique and slightly curved in the upper part and the underleaf insertion is straight in all the American species of this subgenus.

1. **Bazzania bidens** (Nees) Trevisan, Mem. Ist. Lomb. **13**: 415. 1877.

Jungermannia tridens? Montagne, Ann Sci. Nat. Bot. II. **3**: 216. 1835. Non C. G. Nees.
Herpetium stoloniferum var. *bidens* C. G. Nees in Montagne, Ann. Sci. Nat. Bot. II **14**: 333. 1840.
Mastigobryum bidens Gottsche & Lindenberg in G. L. & N. Syn. Hep. 228. 1845.

Plants mostly large, yellow-green, becoming deep brown; stems slender to robust, to 5 cm long, with leaves to 3.5 mm broad; lateral branches mostly 5 mm apart, diverging at a wide angle; flagelliform branches numerous, long. Leaves distant to subimbricate, long, linear-lanceolate, plane or slightly deflexed, 1.5–2 mm long, 0.3–0.5 mm broad at the base, little narrowed to the transversely truncate, bidentate apex; teeth very large, acute, mostly six to eight cells long and three to six cells broad, often divergent, the sinus deep, acute, the margins entire; leaf-cells thin-walled, the trigones large, with bulging sides, mostly coalesced, the lumina angular-rounded, the cuticle faintly verruculose; cells of the apical portion $32 \times 32\,\mu$, a vitta not differentiated. Underleaves small, distant, subquadrate, a little wider than the stem, 0.35–0.4 mm × 0.3–0.35 mm, the apex undulate, variously toothed or lobed. Male branches frequent, the bracts concave, ovate, bifid, crenulate; bracteoles similar, smaller, plane; antheridia in pairs. Female branches solitary, the bracts divided to one-third their length into two or three laciniae, the margins serrate to laciniate. Perianth and sporophyte not seen. Fig. 1, a–h.

Habitat: Over rocks, logs and tree trunks.

PUERTO RICO: s.l., *Schwanecke 729* (G); El Yunque, Luquillo Mts., *Evans 51* (YU, NY); El Yunque, *Steere 4016, 4160, 4407, 5934* (Hb. *Fulford*); *Pagán 494* (NY); Sierra de Naguabo, *Shafer 3750* (NY).

GUADELOUPE: s.l., *l'Herminier 129* (G).

DOMINICA: Morne Trois Pitons, *Elliott 2316* (BM, G).

MARTINIQUE: s.l., *Husnot 241B* (FH, G); Mt. Pelée, *Husnot 246b* (G).

COLOMBIA: Río Kananarí, *Schultes & Cabrera 14445a,* p.p. (US); Río Kuduyarí, *Schultes, Cabrera 14466b* (US).

VENEZUELA: Serrania Parú, *Cowan & Wurdack 31425* (NY).

FRENCH GUIANA: s.l., *Leprieur,* (type G, isotype FH); s.l., ex Hb. Hooker (NY); St. Jean, ex Hb. *Theríot* (G); Cayenne, *Feé 19* (G); *Leprieur 676* (as *Mastigobryum stoloniferum* var. *bidens*) (G).

PERU: s.l., *Lechler* (G).

2. **Bazzania phyllobola** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 372. 1885.

Bazzania bidens var. *dissodonta* Spruce, Trans. Proc. Bot. Soc. Edinb. 15: 371. 1885.
Bazzania dissodonta Spruce ms.
Mastigobryum dissodontum Stephani, Trans. Linn. Soc. II. Bot. **6**: 98. 1901.
Mastigobryum phyllobolum Stephani, Spec. Hep. **3**: 439. 1908.
Mastigobryum heterophyllum Stephani, Spec. Hep. **6**: 466. 1924.

Plants slender, brownish-green becoming deep reddish-brown; stems to 6 cm long, with leaves to 3 mm broad, depressed to ascending; lateral branches frequent, mostly 5 mm apart, diverging at a wide angle; flagelliform branches frequent, long. Leaves approximate to subimbricate, deflexed when dry, asymmetric, elongate-ovate, ascendent, 0.75–1.5 mm long, 0.5 mm broad at the base, narrowed a little to the transversely truncate, bidentate apex; teeth large, acute, six to eight cells long, five to seven cells broad, margins crenulate, serrate, or even shortly denticulate; leaf-cells thin-walled, the lumina rounded, the trigones small, conspicuous, rarely coalesced, the cuticle verruculose; cells of the apical region mostly $20 \times 20\,\mu$; a vitta not conspicuous. Underleaves distant to approximate, more or less quadrate in outline, mostly 0.26–0.32 mm long and broad, the apex irregularly divided into irregular, long or short, blunt to acute teeth, the lateral margins entire or variously toothed. Female branches frequent, the bracts of the intermediate and innermost series ovate, to one-half or more divided into two or three long, slender laciniae one or two cells broad and twelve or more cells long, the lateral margins serrate to ciliate. Perianth-mouth densely long-ciliate. Male bracts and sporophytes not seen. Fig. 2, a–e.

Habitat: In mountain forests, on bases and trunks of trees.

COLOMBIA: Río Apaporís, Raudal Yapacopí, *Schultes, Cabrera & Bell 15438* p.p. (FH); Dep. del Valle, Cordillera Occid., *Cuatrecasas 22082-B* (US).

VENEZUELA: Estado Bolívar, Chimantá Massif, Abacapa-tepuí, *Steyermark 75216* p.p., *75645, 76017* (NY).

BRITISH GUIANA: Roraima 8600′, *McConnell & Quelch 532* (G).

BRAZIL: S. Paulo: Santos, *Schiffner 886* p.p. (W); n'r Río Grande, *Schiffner 1096* p.p. (W); n'r Alto da Serra, 900 m, *Schiffner 1065* (W). Santos: São Vincente, *Horeau 6* (G). Minas Geraes: Caraça, *Wainio 18* (G); subtropics, *Ule 304* (G).

ECUADOR: Azuay: Gualiquiza, *Allioni* (ex Hb. Levier 6577), type of *M. heterophyllum* (G); Oriente-V. Bomboiza, *Allioni, Bryol. Ecuad. 706* (G).

PERU: Mt. Guayrapurina, *Spruce*, (isotypes G, FH).

3. **Bazzania herminieri** (Stephani) Pagán, Bryologist **45**: 90. 1942.

Mastigobryum herminieri Gottsche in Husnot, Rev. Bryol. 2: 3. 1875. (nomen nudum); in Stephani, Hedwigia 25: *8. pl. 4. f. 306.* 1886.

Plants mostly large, light yellow-green at the growing tips becoming dark brown; stems to 10 cm or more long, with leaves 2.0–2.5 mm wide, mostly ascending to erect; lateral branches infrequent, diverging at a wide angle; flagelliform branches numerous, long. Leaves imbricate, often becoming strongly deflexed on drying so that dried stems appear to be laterally compressed, asymmetrically ovate, more or less falcate, to 1 mm long, 0.6–0.72 mm wide at the base, narrowing to the bidentate apex; teeth acute, mostly eight to ten

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FIG. 1. *Bazzania bidens.* 1 a. Stem, ventral view, × 12. 1 b. Leaf attachment on the stem. 1 c. Leaf. 1 d. Cell from the apical portion of a leaf, × 400. 1 e. Underleaves. 1 f. Portion of a transverse section of a stem, × 300. 1 g, h. Female bracts, × 30.

FIG. 2. *B. phyllobola.* 2 a. Stem, ventral view, × 30. 2 b. Depauperate stem. 2 c. Leaf-cell, × 400. 2 d. Female bract of the innermost series, × 30. 2 e. Portion of the perianth-mouth, × 150.

FIG. 3. *B. herminieri.* 3 a. Stem, ventral view, × 12. 3 b. Leaf. 3 c. Portion of a longitudinal section of a stem, × 260. 3 d. Female bracts of the outer, intermediate and innermost series, × 30. 3 e. Portion of the perianth-mouth, × 30.

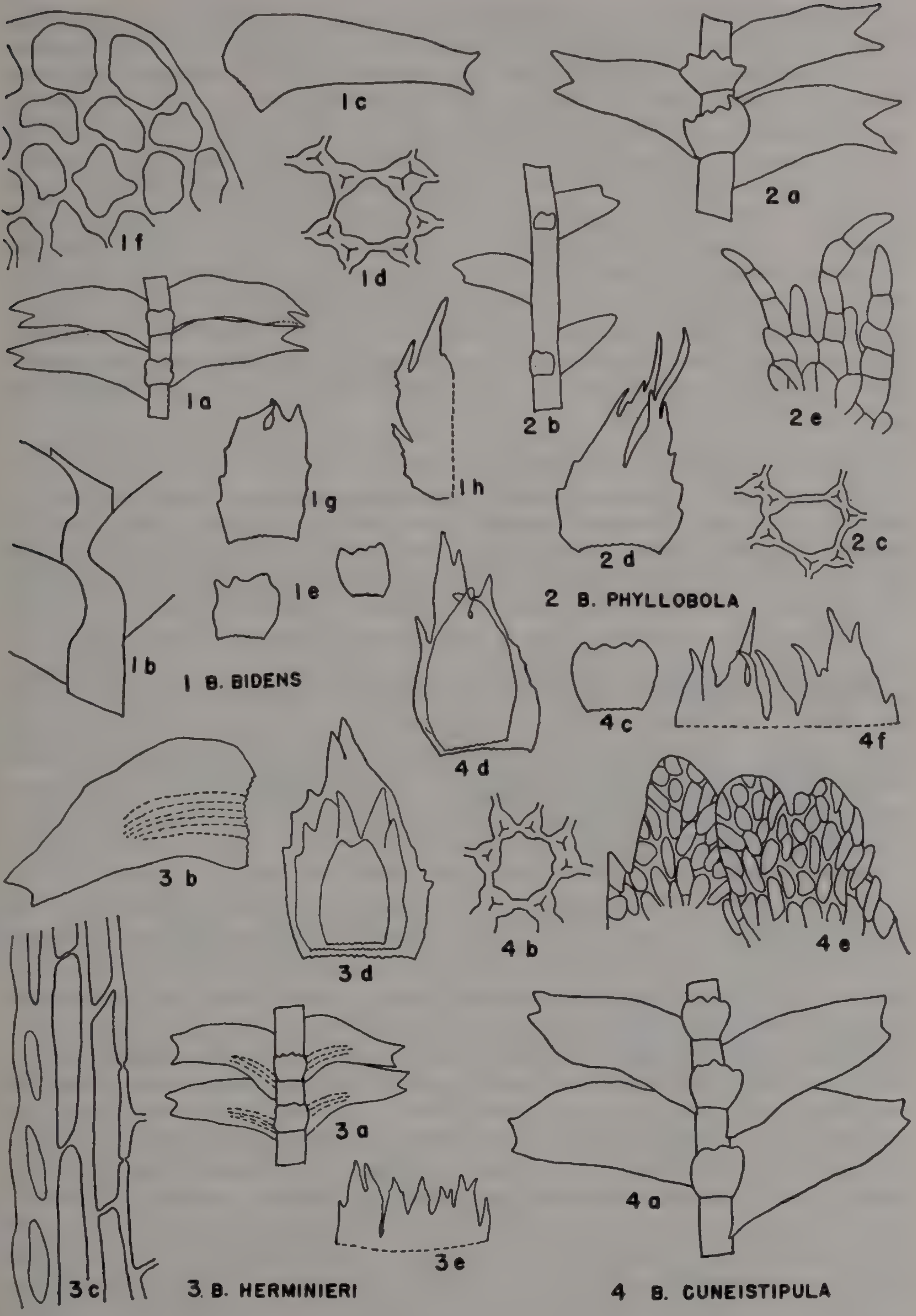

1 f
1 c
1 d
2 a
2 e
1 a
2 b
1 h
1 g
2 d
2 c
1 e
1 b
1 B. BIDENS
2 B. PHYLLOBOLA
4 d
4 c
4 f
3 b
3 d
4 b
4 e
3 a
3 c
3 e
4 a
3 B. HERMINIERI
4 B. CUNEISTIPULA

FIG. 4. *B. cuneistipula.* 4 a. Stem, ventral view, × 30. 4 b. Leaf-cell, × 400. 4 c. Underleaf. 4 d. Female bracts, × 30. 4 e. Upper portion of a female bract of the intermediate series, × 260. 4 f. Portion of the perianth-mouth.

cells broad at the base, six to twelve cells long, widely spreading, the acroscopic tooth the larger, the margins entire; cells of the apical portion of the leaf more or less isodiametric, averaging 18 μ, the trigones large with bulging sides, often becoming coalesced, the cell cavity angular-rounded; cells of the median and basal portions averaging 50 μ long and 25 μ wide, forming a distinct vitta; cuticle verruculose. Underleaves distant, subquadrate, as broad as or broader than the stem, 0.32–0.4 mm wide, 0.2–0.55 mm long, the apex 2–4-lobed. Male branches usually several on a stem, the bracts concave, broadly quadrate-orbicular, averaging 0.56 mm long, to 0.7 mm wide, the apex 2–4-toothed, the bracteoles smaller; antheridia in pairs. Female branches frequent, the bracts of the intermediate series mostly 0.72 mm long and 0.50 mm wide, divided to one-third their length into three or four narrow, mostly blunt, entire segments. Perianth long, of one layer of cells, the mouth divided into numerous, unequal, short to long-pointed laciniae with thick-walled cells, 20 μ–36 μ long. Sporophyte not seen. Fig. 3, a–e.

Habitat: On rocks, stones and tree bases.

GUADELOUPE: Soufrière, *l'Herminier*, distributed in Husnot, *Pl. Antilles 211* (isotypes FH, YU, NY); plants of the same collection as var. *brevifolia* G., forma *applanata* G., and forma *latior* G. (FH); Soufrière, *Duss 1034, 1077* and *1096* as *M. tenerum* (NY); *Duss 62, 98, 102, 122, 302, 309, 310, 321, 328* (FH); s.l., *Marie* (G); forêt de Baines Jaunes, *Le Gallo 225* p.p., *233, 247, 252, 254, 255* (Hb. Le Gallo); Galion, *Le Gallo 263* p.p., *264* p.p., *277* (Hb. Le Gallo).

MARTINIQUE: Mt. Pelée, *Duss 348* (as *M. variabile*) (NY); s.l., *Duss 62* (G).

4. **Bazzania cuneistipula** (Gottsche & Lindenberg) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum cuneistipulum Gottsche & Lindenberg in G. L. & N. Syn. Hep. 225. 1845.
Mastigobryum tenerum Gottsche & Lindenberg in G. L. & N. Syn Hep. 225. 1845.
Mastigobryum variabile Hampe & Gottsche, Linnaea **25**: 348. 1852.
Mastigobryum brevifolium Gottsche, Ann. Sci. Nat. Bot. V. **1**: 141. 1864.
Bazzania tenera Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.
Mastigobryum corticola Stephani, Spec. Hep. **3**: 467. 1908.

Plants small, dull whitish-green to yellow-brown; stems slender, to 5 cm long, with leaves 1 mm–1.5 mm wide, prostrate; lateral branches frequent, 3 mm or more apart, diverging at a wide angle; flagelliform branches numerous, long, often branched, sometimes becoming leafy. Leaves distant to subimbricate, ascending, becoming deflexed or wrapped around the stem when dry, asymmetrically ovate, mostly 0.7–1.0 mm long, narrowing to the bidentate apex; teeth subequal, two to five cells long, spreading, the sinus broad; leaf-cells thin-walled, the trigones conspicuous, often confluent, the lumina angular-rounded, the cuticle verruculose; cells of the apical portion 18–27 μ; a vitta not differentiated. Underleaves distant, as broad as or broader than the stem, squarrose, subquadrate, truncate-trapezoidal to quadrate-orbicular, 0.24–0.36 mm long and wide, the apex 4-lobed. Female branches frequent, the bracts of the intermediate series ovate, averaging 0.64–0.72 mm long, 0.4 mm broad at the base, divided to one-fourth their length into two or three narrow, blunt to acute teeth. Perianth long, the mouth divided into numerous laciniae. Male branches and sporophytes not seen. Fig. 4, a–f.

Habitat: On trees and logs in woods.

CUBA: s.l., *Wright 219* (FH).

JAMAICA: s.l., ex hb. *Hooker* (type W, isotype G); New Haven Gap, *Underwood 911*, *1024, 1054* (YU, NY); slopes of Sir John, *E. G. Britton 1193* (YU); Morce's Gap, *Lewis & Bangey 303* (lJ); Fairy Glade, *M. Farr 777* (lJ); summit of High Peak, *M. Farr 915* (lJ); near Cinchona, *M. Farr 1453* (lJ); s.l., *Harris* as *M. tenerum* (G).

PUERTO RICO: s.l., *Schwanecke*, the type of *M. variable* (B); Sierra de Naguabo 690–1035 m, *Shafer 3712* (NY).

ST. KITTS: Mt. Misery, *Breutel*, type of *M. tenerum* (W).

GUADELOUPE: s.l., *l'Herminier* (FH); s.l., *Duss 1034* (as *M. tenerum*) (G).

MARTINIQUE: Mt. Pelée, *Duss 638* (H).

ST. VINCENT: s.l., *Breutel* (G).

TRINIDAD: s.l., *Crüger* (195); El Tucuche, *Crüger* (G).

COLOMBIA: Mt. Quindio, *Triana & Planchon*, type of *M. brevifolium* (G).

BRAZIL: Lafaiette, *Wainio*, type of *M. corticola* (FH).

5. **Bazzania roraimensis** (Stephani) Fulford, *Bazzania* Cent. S. Am. *f. 6, 7.* 1946.

Mastigobryum roraimense Stephani, Trans. Linn. Soc. II. Bot. **6**: 97. 1901.
Bazzania platystipula Fulford, Bryologist **44**: 145, 146. *f. 1–11.* 1941.

Plants in green to golden-brown or darker brown mats; stems slender, to 5 cm long, with leaves to 2 mm broad, prostrate; lateral branches frequent, 5 mm or more apart, diverging at a wide angle, sometimes becoming flagelliform; flagelliform branches numerous, long. Leaves approximate to imbricate, ascendent, becoming strongly deflexed when dry, asymmetrically narrow-ovate to oblong, 0.6–1.2 mm long, 0.42–0.5 mm broad at the base, narrowed to the bidentate apex; the teeth short, sharp, two to four cells high, two to four cells broad at the base, the sinus lunulate; leaf-cells large, thin-walled, the trigones large, with convex sides, often becoming coalesced, the lumina angular-rounded to stellate, the cuticle faintly verruculose; cells of the apical region 20–36 μ in diameter, a vitta not differentiated. Underleaves distant to imbricate, rounded to subquadrate, to 0.65 mm long and wide, the apex undulate to 4-lobed. Male branches solitary, the bracts ovate, bidentate, the bracteoles smaller; antheridia occurring singly. Female branches solitary, the bracts and bracteoles ovate, the intermediate and innermost series divided to one-third their length into usually three lacineae, the lateral margins ciliate to dentate. Perianth-mouth short-ciliate. Fig. 5, a–f.

Habitat: On tree bases and logs, in mats or among other bryophytes.

JAMAICA: John Crow Peak, 5000–5800 ft, *Underwood 692*, type of *B. platystipula* (type Hb. Fulford, isotypes NY, YU); summit of John Crow Peak, *M. Farr, 969, 990* (lJ); Blue Mountain Peak, *Patterson 23* (Hb. Patterson) summit of High Peak, *M. Farr 904* (lJ); near Cinchona, *M. Farr 1453* (lJ).

PUERTO RICO: Luquillo Mts., *E. G. Britton* (NY); El Yunque, *Steere 5934* (Mich).

COLOMBIA: Dep. Norte del Santander, *Cuatrecasas 12449 B* (US).

BRITISH GUIANA: summit of Mt. Roraima, *McConnell & Quelch 523* (G); same locality *McConnell & Quelch 523* (type G, isotype FH).

GUIANA: s.l., *Quelch 11* (G).

BRAZIL: S. Paulo, near Taipas, *Schiffner 1021* p.p. (W); Sevilla, 3400 m. *Karling 2338* p.p. (Hb. Herzog).

6. **Bazzania gracilis** (Hampe & Gottsche) Stephani, Hedwigia **27**: 279. 1888.

Mastigobryum gracile Hampe & Gottsche, Linnaea **25**: 346. 1852.
Bazzania bidens Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 371. 1885. Not *M. bidens* Gottsche & Lindenberg.
Bazzania bidens var. *vittata* Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 371. 1885.

Mastigobryum cuneifolium Gottsche in Duss, Fl. Crypt. Antilles Fr. Hep. 23. 1903. (nomen nudum.)
Mastigobryum parvum Stephani, Spec. Hep. 3: 438. 1908.
Bazzonia trichodes Spruce ms. *Hepat. Spruc.*
Bazzania bidens var. Spruce ms. *Hepat. Spruc.*
Mastigobryum trichoideum Stephani, Spec. Hep. 3: 532. 1909.

Plants scattered or in depressed mats, slender forms yellow-brown to red-brown, larger plants yellow-green to olive-green; stems slender to filiform, prostrate to ascending near the tips, to 5 cm long, with leaves 1.5–2.0 mm wide, the leaves often becoming scale-like; lateral branches frequent, 3 mm–10 mm apart, diverging at a very wide angle; flagelliform branches numerous, very long, often branched. Leaves distant to subimbricate, ascendent, becoming convex on drying, in the normal condition asymmetrically ovate, averaging 0.65–0.85 mm long and 0.4 mm wide at the base, narrowing to the apex, often much smaller and scale-like, becoming nearly symmetric and to 0.5 mm or less long and 0.3 mm wide at the base; the apex irregularly 2-toothed or acute in the smaller leaves, the teeth two or three cells long, the acroscopic tooth often the longer, the sinus broad, lunulate to acute; leaf-cells thin-walled, the trigones small, conspicuous, often confluent, the lumina angular-rounded, the cuticle smooth to faintly verruculose; cells of the apical portion 16–20 μ in diameter, those of the basal portion mostly $40 \times 15\ \mu$, forming a narrow but usually distinct vitta. Underleaves small, distant, as broad as the stem, quadrate to quadrate-orbicular, mostly 0.2–0.32 mm long, much smaller in reduced forms, the apex straight or shortly 1–4-toothed or -lobed. Male branches frequent, usually several on a stem, the bracts ovate, bifid, emarginate to crenulate, the bracteoles similar, smaller. Female branches occasional, the bracts and bracteoles of the innermost series broadly ovate, divided to one-third of their length into three dentate to ciliate laciniae. Perianth-mouth laciniate. Fig. 6, a–f.

Habitat: Over logs, rocks and soil or tree bases in forests.

CUBA: Oriente, Sierra Maestra, *Morton 9443, 9529* (US).

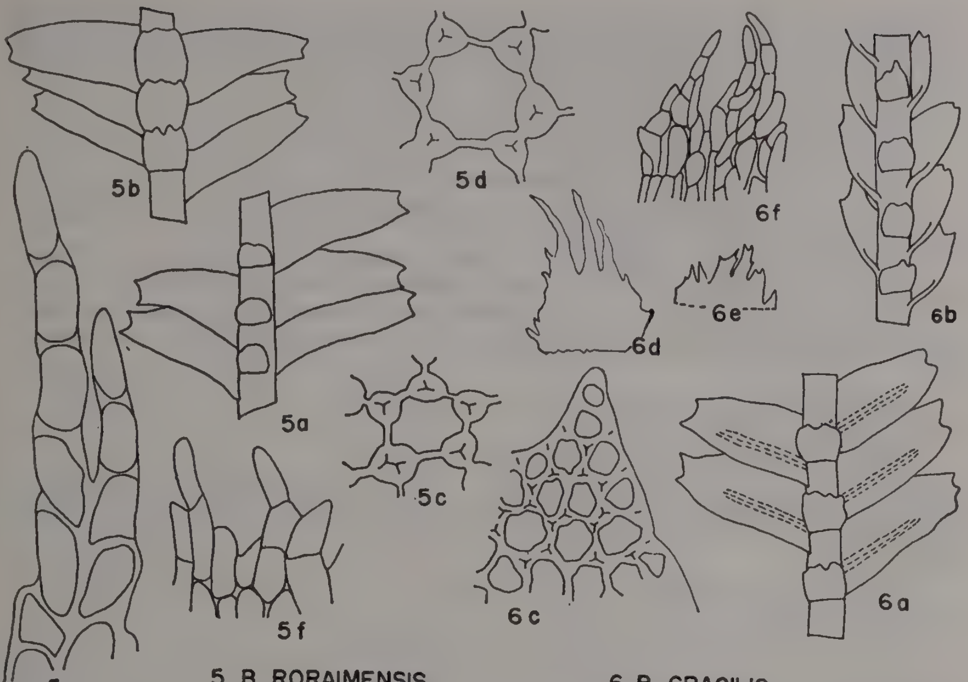
JAMAICA: Blue Mountain Peak, *Johnson 39.1* (F); Caledonia Peak, *M. Farr 1009* (IJ); Cinchona, *Cummings 11* (NY); Fairy Glade, *M. Farr 769, 779, 783, 784, 787* (IJ); Green Hill Wood, 4000 ft, *Harris 12* (NY); Hardwar Gap, *Baxter 9* p.p., *11* p.p. (KANU); Hardwar Gap to Waterfalls, *M. Farr 1213,* (IJ); near John Crow Peak, *M. Farr 722* p.p. 930 (IJ); base of John Crow Peak, 5000–6000 ft, *Underwood 2361* (YU, NY); John Crow Peak, 5500–5800 ft, *Underwood 657, 659, 823, 2360* (YU, NY), Morce's Gap, 5000 ft, *Underwood 530, 621, 632* (YU, NY), Mt. Horeb, *Welch 17811 p.p., 17867* (Hb. Welch); New Haven Gap, *Underwood 911* (as *B. cuneistipula*) (YU, NY); New Haven Gap, *Johnson 19* (YU, F); Portland Gap, 1650 m, *Maxon & Killip 1195* (FH, YU, NY); near Portland Gap, *Bengry 256* p.p. (IJ); between Sir John's and High Peak, *Lewis 70* (IJ); s.l., *Börgensen* (as *M. cuneistipulum*) (G); s.l., *Hansen* (G); s.l., *Orcutt 3170, 5107, 5223* (BM); s.l., *Sherring 8* (BM).

FIG. 5. *Bazzania roraimensis.* 5 a. Stem, ventral view, × 15. 5 b. Robust stem (*B. platystipula*), × 15. 5 c, d. Cells from the apical portion of leaves, × 400. 5 e. Segment from an innermost female bract, × 310. 5 f. Portion of the perianth-mouth, × 150.

FIG. 6. *B. gracilis.* 6 a. Portion of stem, ventral view, × 30. 6 b. Filiform stem, × 30. 6 c. Tooth of a leaf, × 260. 6 d. Female bract of the innermost series (immature). 6 e. Portion of the perianth-mouth. 6 f. Cells of the perianth mouth, × 180.

FIG. 7. *B. affinis.* 7 a. Stem, ventral view, × 30. 7 b. Leaf. 7 c. Apices of leaves. 7 d. Leaf-cell, × 350. 7 e. Underleaves, C, chlorophyllose area, H, hyaline part.

FIG. 8. *B. pallide-virens.* 8 a. Stem, ventral view, × 8. 8 b. Leaf-cell, × 400. 8 c. Underleaves, × 30; C, chlorophyllose area, H, hyaline part. 8 d. Female bract of an intermediate series, × 40.


5b
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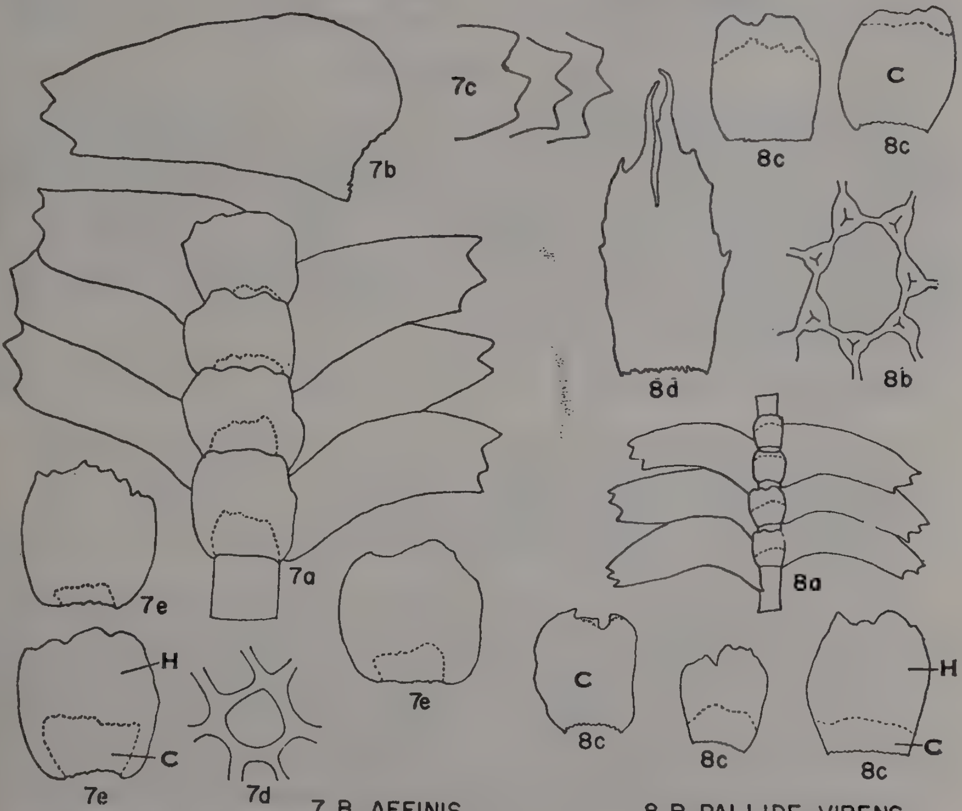
5 B. RORAIMENSIS

6 B. GRACILIS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7 B. AFFINIS

8 B. PALLIDE-VIRENS

PUERTO RICO: El Yunque, *Pagán 486* (NY); *Steere 4277, 4302, 7110* (Hb. Fulford); El Yunque, Luquillo Mts., *Evans 57* (YU, NY); Río de Maricao, 500–600 m, *E. G. Britton 2682* (NY); Sierra de Naguabo, 465–720 m, *Shafer 3758* (NY); s.l., *Schwanecke*, (type B, isotypes FH, G); Cerra de la Punta, *Steere 6241* (Hb. Fulford).

GUADELOUPE: s.l., *l'Herminier* (as *M. cuneistipulum*) (G).

MARTINIQUE: s.l., *Duss 638* (as *M. cuneistipulum*) (G).

HONDURAS: near Achote, *Yuncker 6615* p.p. (DPU).

COSTA RICA: s.l., *Werckle* (YU, NY); Cartago: Santa Clara, *Torres 219.3* (F); Zurqui, *Standley 48091* (as *B. phyllobola*) (US).

GUATEMALA: Alta Verapaz: near Cobán, 1350 m, *Turckheim 5425* (as *M. phyllobolum*) (NY); same locality, *Türckheim*, in hb. Levier 5822 (as *M. phyllobolum*) (G).

COLOMBIA: Serra do la Mascasena, *Phillipson & Idrobo 2131* p.p., *2158* p.p. (BM); Río Miritiparaná, *Schultes & Cabrera 15789* (FH); Río Papuri, *Schultes & Cabrera 19458* (FH).

VENEZUELA: Serrania Parú, *Cowan & Wurdack 31268* (NY); above Maturin near Las Trinchieras, *Alston 5586* (BM).

BRITISH GUIANA: Mt. Roraima, *McConnell & Quelch, 3341, 11* p.p. (G).

BRAZIL: Rio de Janeiro, *Glaziou* (NY); Rio de Janeiro, *Glaziou 4532*, type of *M. parvum* (FH); Rio Negro & Uaupes, *Spruce* (as *B. bidens*) (YU, NY); Manáos and San Carlos, *Spruce* (as *B. bidens var.*) (YU, NY). Minas Gerais: Caraça, *Wainio 13* (as *M. phyllobolum*) (G).

ECUADOR: Mt. Chimborazo, *Spruce*, isotype of *B. trichodes* Spruce (NY); *Spruce*, with *B. leptostipa* (NY).

SUBGENUS TRIDENTATAE

The plants of this subgenus are characterized by three-toothed leaves, although in a few species the teeth are inconspicuous or the leaves are undivided.

Section 1. Grandistipulae

The plants of this section may be very large to small. The leaves lack a vitta (only rarely is it faintly developed) and conspicuous ventral auricles or appendages (except in *B. arcuata* and *B. denticulata*). The margins of the teeth are entire (except that they are crenulate and toothed in *B. denticulata*, and serrate in *B. serrata* and *B. chimborazensis*). The line of leaf insertion is oblique and curved in the upper portion or oblique and hook-form at the upper end. The underleaves are attached in a straight or sometimes a curved line. They are always free from the leaves.

7. **Bazzania affinis** (Lindenberg & Gottsche) Trevisan. Mem. Ist. Lomb. **13**: 415. 1877.

Mastigobryum affine Lindenberg & Gottsche in G. L. & N. Syn. Hep. 720. 1847. Non *M. affine* Mitten in Hooker, Bot. Ant. Voy. 2^2 (Fl. N. Zel.): 147. *pl. C. f. 4.* 1854.
Mastigobryum lindigii Stephani, Hedwigia **25**: 203. *pl. 3, f. 44–45.* 1886.
Bazzania lindigii Spruce, Mem. Torrey Club **1**: 129. 1890.
Mastigobryum inciso-bilobatum Stephani in Herzog, Biblioth. Bot. **87**: 224. *f. 165, a–b,* 1916.

Plants of medium size, scattered or in pale yellow-green to olive-green mats; stems slender, to 5 cm or more long, with leaves 2–3 mm broad, prostrate; lateral branches 0.5–1.5 cm apart, diverging at a wide angle; flagelliform branches frequent, long; rhizoids on the bases of the underleaves. Leaf insertion little curved in the upper part. Leaves approximate to imbricate, ascendent, spreading, sometimes deflexed when dry, asymmetrically ovate, 1.0–1.6 mm or more long, 0.56–0.8 mm broad at the base, narrowed to the transversely truncate, tridentate apex; teeth deltoid, acute, four to six cells long and broad;

leaf-cells with uniformly thickened walls, the trigones tiny or absent, the lumina rounded, the cuticle verruculose; cells of the apical portion $18 \times 18\ \mu$, those of the median portion larger. Underleaves distant to imbricate, quadrate to longer than broad, hyaline in part or throughout except for a small internal region at the base, 0.48–0.56 mm long, the apex undulate or with two to four short lobes; sexual branches and sporophyte not seen. Fig. 7 a–e.

Habitat: In forests, on stones, decaying logs and on trees.

MEXICO: Teotalcingo, *Liebmann*, (type G, isotype FH); Chinantla, *Liebmann* (as *β dentibus minoribus*) (G); without locality or collector, (NY).

GUATEMALA: Pitoreal, *Sharp 2771b* (TENN).

COLOMBIA: Bogotá, *Weir* (NY); s.l., *Lindig*, the type of *M. lindigii* (G); Cordillera La Macarena, Cano Teranas, 1700 m, *Schultes 11258* (FH).

PERU: San Gavan, *Lechler* (NY).

BOLIVIA: Río Tocorani, *Herzog 4073*, type of *M. inciso-bilobatum* (L); Yungas, 6000 ft, *Rusby 3023* (G)..

8. **Bazzania pallide-virens** (Stephani) Fulford, *Bazzania* Cent. S. Am. 42. *f. 11.* 1946.

Mastigobryum pallide-virens Stephani, Spec. Hep. 3: 473. 1908.

Plants large, olive-green to dark green, becoming brownish; stems to 6 cm or more long, with leaves to 3.5 mm broad; lateral branches 1 cm or more apart, diverging at a wide angle; flagelliform branches numerous. Line of leaf insertion curved in its upper part. Leaves spreading, rarely becoming falcate, asymmetric, ovate to elongate-oblong, 1.8–2.3 mm long, 0.5–0.6 mm broad at the base, narrowed a little to the transversely truncate, tridentate (often quadridentate) apex; teeth variable, three to eight cells long, three to six cells broad at the base, the margins entire; leaf-cells thin-walled, the lumina angular-rounded, the trigones conspicuous, the cuticle verruculose; cells of the apical region $20\text{–}32 \times 22\ \mu$. Underleaves large, quadrate to elongate, the apex truncate, variously lobed, irregularly and sparingly short-spinose to dentate and incised, chlorophyllose throughout or with a hyaline border of several rows of cells, or hyaline throughout on some branches, the cells $24\text{–}36 \times 20\ \mu$. Male branches occasional, the bracts and bracteoles concave, broadly ovate, shortly bifid; antheridia occurring singly. Female branches frequent, the bracts and bracteoles large, the intermediate and innermost series long-laciniate. Perianth and sporophyte not seen. Fig. 8, a–d.

Habitat: In mountain rain forests, on trees, tree roots and moist cliff faces.

COLOMBIA: Río Apaporis, *Schultes & Cabrera 12548, 12550* (FH); Río Kananarí, *Schultes & Cabrera 13112* (FH); Río Kuduyarí, *Schultes & Cabrera 17909* (FH); Río Miritiparaná, *Schultes & Cabrera 16542, 16554* (FH); Río Paca, *Schultes & Cabrera 19509* (FH); Río Papury, *Schultes & Cabrera 19455* (FH); Río Piraparaná, *Schultes & Cabrera 17273* (FH); Río Vaupés, Cerro de Mitú, *Schultes & Cabrera 13857* (FH); Yapoboda, *Schultes & Cabrera 14300* (FH); Dep. del Valle: Bahia de Buenaventura, *Cuatrecasas 19993-B* (US).

VENEZUELA: Campo Cano, *Cowan & Wurdack 31275* (NY); Cerro Huachamacari, *Maguire, Cowan & Wurdack 31275* (NY); Cerro Yapacana, *Maguire, Cowan & Wurdack 30609* (NY); Serrania Parú, *Cowan & Wurdack 31428* (NY).

BRAZIL: s.l., *Glaziou 14418* (type G, isotype FH); Manáos and San Carlos, *Spruce, Hep. Spruc.* (as *B. bidens* var.) (NY); the same (under *B. brasiliensis* n. var.) (NY); Rio de Janeiro, *Glaziou 14418* (as *M. wrightii*) (NY).

ECUADOR: Mt. Chimborazo, *Spruce, Hep. Spruc.*, with *B. trichoidea*, (NY).

PERU: Tarana, *Spruce, Hep. Spruc.* (under *B. wrightii*) (NY).

9. **Bazzania stolonifera** (Swartz) Trevisan, Mem. Ist. Lomb. **13**: 415. 1877.

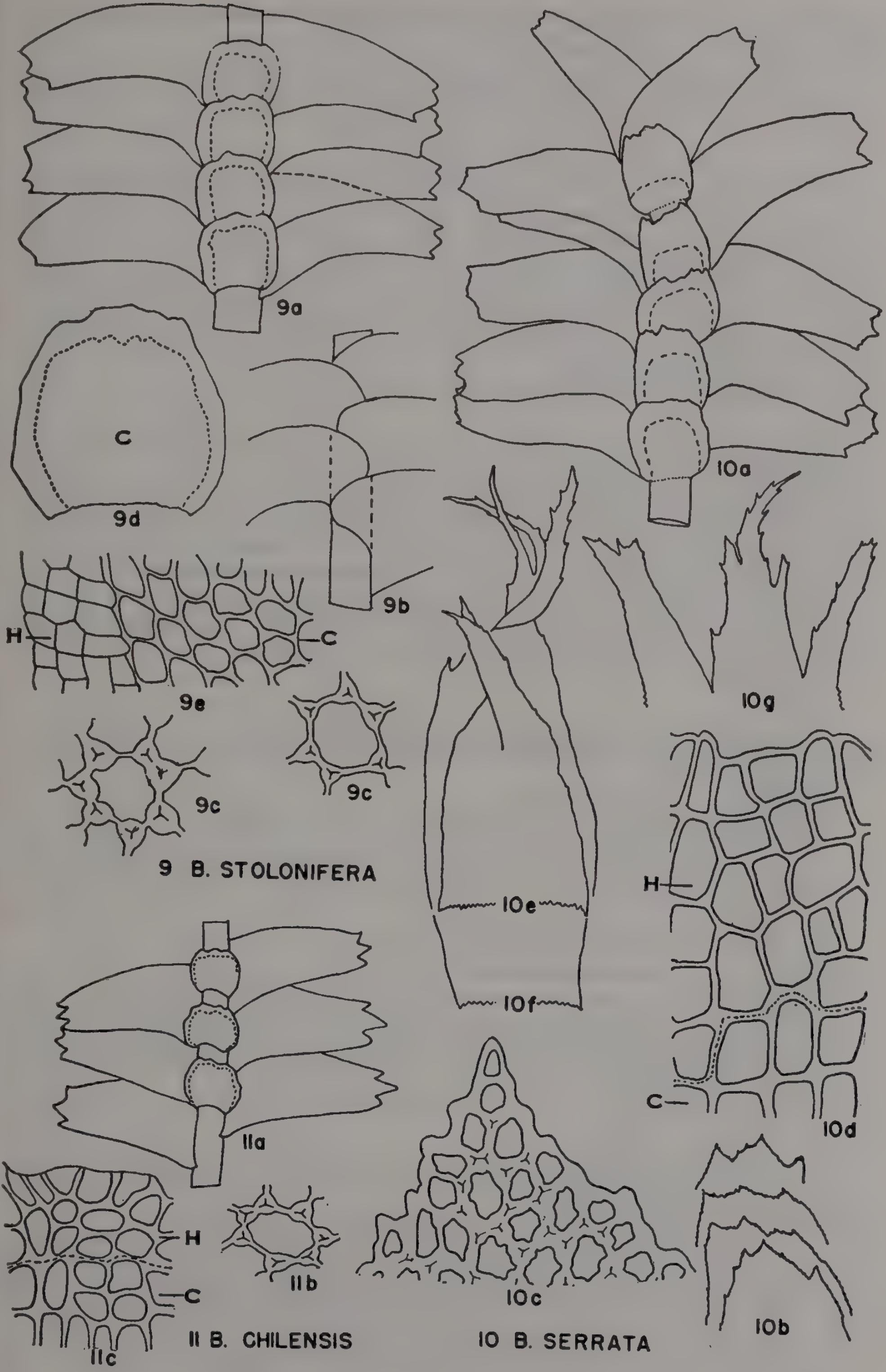
Jungermannia stolonifera Swartz, Prodr. Fl. Ind. Occ. 144. 1788.
Pleuroschisma stoloniferum Dumortier, Recueil Obs. Jungerm. 20. 1835.
Jungermannia vincentiana Lehmann & Lindenberg in Lehmann, Pug. Pl. **4**: 59. 1832.
Herpetium vincentianum Montagne in D'Orbigny, Voy. Amér. Mérid. 7^2: 74. 1839.
Herpetium stoloniferum Montagne in D'Orbigny, Voy. Amér. Mérid. 7^2: 74. 1839.
Mastigobryum stoloniferum Lindenberg in G. L. & N. Syn. Hep. 227. 1845.
Mastigobryum vincentinum Lehmann & Lindenberg in G. L. & N. Syn. Hep. 226. 1845.
Bazzania vincentina Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.
Bazzania leptostipa Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 374. 1885.
Mastigobryum quelchii Stephani, Spec. Hep. **3**: 471. 1908.
Mastigobryum leptostipum Stephani, Spec. Hep. **3**: 524. 1909.
Mastigobryum turkheimii Beauverd in Stephani, Spec. Hep. **6**: 481. 1924.
Mastigobryum sylvaticum Stephani, Spec. Hep. **6**: 481. 1924. (as syn.) Non *M. sylvaticum* Gottsche.
Mastigobryum azuayense Stephani, Spec. Hep. **6**: 454. 1924.

Plants large, dull olive-green to brownish-green, light yellow-green at the growing tips; stems stout, to 10 cm or more long, with leaves to 5 mm wide; lateral branches numerous, 1 cm or more apart, diverging at a wide angle; flagelliform branches numerous, long, often branched. Line of leaf insertion curved in the upper part. Leaves widely spreading, imbricate, nearly plane, becoming convex on drying, often strongly deflexed, asymmetrically ovate, to 3 cm long on robust plants, to 1.5 mm wide at the base, narrowing to the transversely truncate, tridentate apex; teeth spreading, deltoid, acute to subobtuse, mostly unequal, three to seven cells long, three to seven cells wide at the base, the sinuses broad, the margins straight to undulate; leaf-cells thin-walled, the trigones small to large with convex sides, the lumina angular-rounded to stellate, the cuticle verruculose; cells of the apical portion 25 μ long × 21 μ. Underleaves round-quadrate, broader than the stem, mostly 0.7–0.8 mm long, 0.8–1.0 mm wide, with a hyaline border of four to eight or more rows of cells, the apical margin broadly undulate, with three or four lobes, the bases rounded to semi-cordate; hyaline cells 18–30 μ × 15–18 μ, thin-walled, with few trigones, the chlorophyllose cells with conspicuous trigones. Male branches to 1 mm long, the bracts broadly ovate, 0.6 × 0.5–0.6 mm wide, strongly concave, bi- or tridentate with short, broad teeth, the bracteoles smaller; antheridia borne singly or in pairs. Female branches several on a stem, the bracts of the innermost series 1.5–1.8 mm long × 0.85–0.95 mm wide at the base, divided to one-third or one-fourth their length into two to four long, narrow, crenulate segments. Perianth long, the mouth contracted, short-ciliate to dentate. Sporophyte capsule 1.5 mm long, ovoid-cylindric, of four or five layers of cells. Elaters 390 μ long, 18 μ wide, bispiral. Spores 15–18 μ, minutely punctate. Fig. 9, a–e.

FIG. 9. *Bazzania stolonifera.* 9 a. Stem, ventral view, × 12. 9 b. Stem, dorsal view, showing leaf attachment, × 12. 9 c. Cells from the apical portions of leaves, × 375. 9 d. Underleaf, × 30; C, chlorophyllose cells. 9 e. Cells of the lateral margin of an underleaf, × 200; C, chlorophyllose cells, H, hyaline border.

FIG. 10. *B. serrata.* 10 a. Stem, ventral view, × 30. 10 b. Apices of leaves, × 40. 10 c. Tooth of a leaf, × 350. 10 d. Portion of the apical margin of an underleaf, × 350; C, chlorophyllose cells, H, hyaline border. 10 e. Female bract of the outer series, × 80. 10 f. Female bract of the innermost series, × 80. 10 g. Portion of the perianth-mouth.

FIG. 11. *B. chilensis.* 11 a. Stem, ventral view, × 15. 11 b. Leaf-cell, × 400. 11 c. Portion of the upper margin of an underleaf, × 310; C, chlorophyllose cells, H, hyaline border.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9 B. STOLONIFERA

11 B. CHILENSIS

10 B. SERRATA

Habitat: Very abundant in forests throughout tropical America, in deep tufts or mats on soil, logs and trees.

CUBA: Santiago de Cuba, *Funck & Schlim 2097* (FH); s.l., *Bro. Hioram 398.3* (NY).

JAMAICA: s.l., *Swartz* (type B, isotypes FH, NY); Bellevue, *Lewis 87, 94* (IJ); Blue Mountain, *Bennett* (NY), *Britton 1103, 1190, 1227* (YU, NY); Caledonia Peak, *M. Farr 1010* p.p. (IJ); Cinchona to Morce's Gap, 5000 ft, *Underwood 273* (NY); summit of Cuna Cuna Mountain, *M. Farr 1388, 1391* (IJ); Doll Woods, *Evans 495* (YU); sw of Ecclesdown, *M. Farr 1143* (IJ), *O'Regan 1476* (IJ); Fairy Glade, *M. Farr 533, 781* p.p. (IJ); Greenwich Woodlands, 4500 ft, *Harris 11,170* (NY); near Hardwar Gap, 4000 ft, *Underwood 2240* (YU, NY); Hardwar Gap, *Baxter 30* p.p. (KANU); Hardwar Gap to waterfall, *Porter 436* (IJ); base of John Crow Peak, 5000–5500 ft, Underwood *2327, 2328, 2370, 2421, 2426* (YU, NY); John Crow Peak near Cinchona, *E. G. Britton 213* (NY); John Crow Peak, 5500–5800 ft, *Underwood 684, 825, 832, 834, 2427, 2428*, (YU, NY); Morce's Gap-New Haven Gap, *Patterson* (Hb. Fulford); Morce's Gap, 1500 m, *Maxon & Killip 647* (YU, NY); New Haven Gap, *Evans 537* (YU); Sir John's Peak, *Lewis 96* (IJ); s.l., *Menzies 101* (NY); s.l. *Wilson 768* (NY); s.l., *Orcutt 5220* (BM).

ST. KITTS: Mt. Misery, *Breutel* (NY), *Britton & Cornell 508* (NY); s.l., *Breutel* (G, NY).

PUERTO RICO: El Yunque, *Evans 110* (YU, NY), *Steere 4014, 4305, 4388, 5939* (Hb. Fulford); Mt. Britton, *Jones 10978* (FH); Sierra Luquillo, *Br. Hioram 403* p.p. (NY), *Sintenis* H 16 (G); s.l. *Sintenis 92* (as *B. wrightii*) (NY).

GUADELOUPE: Mornes des Deus Marnelles, *Duss 282* p.p. (NY); forêt de Baines Jaunes, *Le Gallo 676* p.p. (Hb. Le Gallo); St. Rose, *l'Herminier* (FH); Soufrière, *Duss 66, 205, 320*, as *M. portoricense* (NY); s.l., *Madianna* (NY); s.l., *l'Herminier 55, 119* (NY), s.l., *Husnot, Pl. Antilles no. 212* (NY); s.l., *l'Herminier, Gottsche & Rabenhorst, Hep. Eur. no. 561* (YU, NY); s.l., *Dürchessaing 576* (G).

DOMINICA: s.l., *Elliott 1020, 2212* (G); Morne Consonne, *Elliott 201a* p.p. (BM); near Laudat, *Elliott 502a* p.p. (BM); Morne Trois Pitons, *Elliott 729c* (BM); Morne Diablotin, *Elliott 1060a* p.p., *1068* (BM); Castle Bruce River, *Elliott 1618* (BM).

MARTINIQUE: Calebasse, Mt. Pelée, *Duss 117* (NY); s.l., *Husnot, Pl. Antilles no. 212* (NY).

ST. VINCENT: St. Andrews, *Guilding*, ex. Hb. Hooker, type of *J. vincentina* (NY); Mt. St. Andrews, *Elliott 80c* p.p. (BM); s.l., *Menzies* (NY); s.l., *G. W. Smith* (FH); s.l., Hb. Hooker 170 (NY).

GRENADA: s.l., *Eggers 6153* (B).

MEXICO: Capital, *Karsten 9* (G); Oaxaca, *Santos 3486* (MICH).

GUATEMALA: Cobán, *Turckheim 5816*, type of *M. turckheimii* (G); *Turckheim 5582* (as *M. viridissimum*) (FH), *5418* (as *M. quelchii*) (FH); Zacapa, *Steyermark 29966* (F); Chiquimula, *Steyermark 31011* (F); Las Palmas, *Steyermark 51681* (F); Alta Verapaz, *Standley 91431* (F).

BRITISH HONDURAS: Camayaguam, 1800 m, *Yuncker, Dawson & Youse 6617, 6618* (DPU).

HONDURAS: near El Achnote, *Yuncker 6613* (DPU).

COSTA RICA: Alto de la Estrella, *Standley 39101* (F); Brushik, 300 m, *Pittier* (G); Cartago, *Maxon 502* (NY); Cerro de las Lajas, *Standley 51612*, forma *rufescens* [*Herzog*] (US); Laguna de la Chonta, *Standley 42240* (US); Yerba Buena, *Standley, 49842, 49882, 49949* (US), forma *defolians* [*Herzog*] *49869* (US); formae *minor* and *ramulosa* [*Herzog*] *49891* (US).

PANAMA: Chiriquí, Holcomb Trail, *Mrs. Cornman 3139, 3158* (MO); Chiriquí, *Mrs. Cornman* (MO).

COLOMBIA: s.l., *Wallace* (NY).

VENEZUELA: without locality or collector (G); s.l., *Fendler* (G) between Valencia and Maracay, *Alston 6148, 6149* (BM).

BRITISH GUIANA: Mt. Roraima, *Quelch*, type of *M. quelchii* (FH).

BRAZIL: Minas Gerais, *Wainio 17* (G); Rio de Janeiro, *Glaziou 4572* (G, NY), *Glaziou 1212* (G); Espírito Santo, *Ynes Mexia 4076* (FH, NY). S. Paulo: s.l., *Kroner 10* (G); near Barra Mansa, *Schiffner 357, 358, 498, 506, 507, 1808, 1847, 2062* (W); Campo Grande, *Schiffner 463* p.p., *466, 467, 479* p.p. (W); Rio Grande, *Schiffner 798* (W); Alto da Serra, *1083* (W); Brasso Grande, Itapecerica, *Schiffner 1264, 1317, 1405, 1547* p.p., *1714, 1715* (W).

ECUADOR: Azuay: Oriente-V. Bomboiza, *Allioni 601, 713* (as *M. arcuatum*) (G). Mt. Chimborazo, *Spruce, Hep. Spruc.*, type of *B. leptostipa* (isotype YU).

While the plants of *B. stolonifera* may show considerable variation in the width of the hyaline border of the underleaves, they may be readily distinguished from the other South American species with hyaline cells on the underleaves, in that the hyaline cells are always thin-walled and the chlorophyllose cells have distinct trigones.

10. Bazzania serrata Fulford, Bull. Torrey Club **86**: 321. *f. 17–30.* 1959.

Plants of meduim size, dull olive-green, yellowish-green at the growing tips, in tufts or mats; stems to 4 cm long, with leaves to 3 mm broad; lateral branches 1 cm or more apart, diverging at an acute angle, flagelliform branches frequent. Line of leaf insertion curved in the upper part. Leaves widely spreading, imbricate, plane, often caducous, serrate throughout, averaging 2 mm long, 0.6 mm broad at the base, little narrowed to the 1–3-toothed apex, the teeth three to six cells broad at the base, two to five cells high, the sinuses broad; cells of the apical portion 24–27 × 18 μ, the trigones conspicuous or coalesced, those of the median portion 36 (or more) × 27 μ, suggesting a vitta; the cuticle coarsely verruculose. Underleaves imbricate, round-quadrate in outline, mostly 0.46 mm long and wide, with a narrow hyaline border surrounding the chlorophyllose part, or hyaline nearly to the base, the margins serrulate from projecting cells. Female branches several on a stem, the bracts and bracteoles oblanceolate, the bracts of the innermost series to 2.4 mm long (immature), divided to one-third their length into three or four long, narrow, crenate laciniae. Perianth to 5 mm long, ovoid-cylindric, contracted to the long-laciniate mouth. Male branches and sporophytes not seen. Fig. 10, a–g.

Habitat: Forests at 2150–2230 m alt.

COLOMBIA: Cordillera Oriental, Norte de Santander: Sarare, 2150–2250 m, *Cuatrecasas, Schultes & Smith 12448z* (type US).

11. Bazzania chilensis (Stephani) Fulford, *Bazzania* Cent. S. Am. 51. *f. 15.* 1946.

Mastigobryum chilense Stephani, Hedwigia **24**: 247. *pl. 2. f. 1.* 1885.
Mastigobryum bogotense Stephani, Hedwigia **24**: 246. *pl. 1. f. 1.* 1885.

Plants of medium size, dark green, pigmented with brown; stems to 3 cm or more long, with leaves to 3 mm broad; lateral branches frequent, diverging at a wide angle; flagelliform branches frequent. Line of leaf insertion curved in its upper part. Leaves imbricate, plane, becoming a little deflexed when dry, asymmetrically ovate, straight or nearly so, 1.4–1.8 mm long, 0.6 mm broad at the base, narrowed to the transversely truncate, tridentate apex; teeth large, eight to twelve cells long, five to ten cells broad at the base, the margins entire; leaf-cells thin-walled, with conspicuous, often confluent trigones, the lumina angular-rounded, the cuticle strongly verruculose; cells of the apical portion mostly 20 × 20 μ. Underleaves distant to imbricate, broader than the stem, round-quadrate, 0.43 mm long and 0.5 mm broad, with a hyaline border, the apex truncate, mostly straight, crenulate, the hyaline border of two to four rows of cells at the apex and one or two rows of cells on the lateral margins, the cells averaging 16 μ, the walls thin, the trigones small but distinct. Sexual branches not seen. Fig. 11, a–c.

Habitat: Not given.

COLOMBIA: s.l., *Schlim 861* (lectotype G, isotype FH); Bogotá, Tequendama, 2500 m, *Lindig*, type of *M. bogotense* (G).

PERU: Talanara, *Lechler* (G.)

BOLIVIA: Yungas, 6000 ft, *Spruce* (NY).

CHILE: s.l., *Lechler 13* (G).

12. Bazzania taleana (Gottsche) Fulford, *Bazzania* Cent. S. Am. 54. *f. 16* 1946.

Mastigobryum taleanum Gottsche, Mex. Leberm. 131. 1863.
Mastigobryum longiscuspe Stephani, Spec. Hep. 3: 472. 1908.
Mastigobryum variedentatum Stephani in Herzog, Biblioth. Bot. 87: 225. *f. 166.* 1916.

Plants delicate, of medium size, olive-green, becoming brown in the older portions; stems to 3 cm or more long, with leaves to 2.5 mm broad; lateral branches frequent, mostly 5 cm apart, diverging at a wide angle; flagelliform branches frequent. Line of leaf insertion curved in its upper part. Leaves imbricate, plane to deflexed, asymmetrically ovate, spreading, 1–1.5 mm long, 0.5 mm broad at the base, narrowed a little to the transversely truncate, tridentate apex; teeth narrow, sharp, five to eight cells long, four to six cells broad at the base, usually ending in a row of two cells, the sinuses broad, lunulate, the margins mostly entire; leaf-cells quadrate, with thin walls and minute trigones, the lumina rounded, the cuticle faintly verruculose; cells of the apical region mostly 16–20 × 18 μ. Underleaves distant to imbricate, round-quadrate, broader than the stem, 0.55–0.65 mm long × 0.5–0.6 mm broad, sometimes hyaline in part, the apex mostly entire, repand to undulate. Sexual branches not seen. Fig. 12, a–e.

Habitat: On tree trunks in forests.

MEXICO: Oaxaca, Mt. Talea, *Liebmann*, (type FH) [the presumed isotype in the Stephani Herbarium (G) was a poorly preserved plant of another species]; Vera Cruz: El Puerto, *Sharp 641* p.p. (TENN).

VENEZUELA: Cumbre, *Maguire, Cowan & Wurdack 30698* (NY).

BRAZIL: Apiahy, Puiggari, type of *M. longicuspe* (FH); S. Catarina de Padres, 1900 m, *Reitz 2-566, 2-604* (HBR); São Paulo: Rio Grande, *Schiffner 684* (W); Serra do Itatiaya, 2100 m, *Dusén 50, 387* (G).

BOLIVIA: Comarapa, *Herzog*, type of *M. variedentatum* (L).

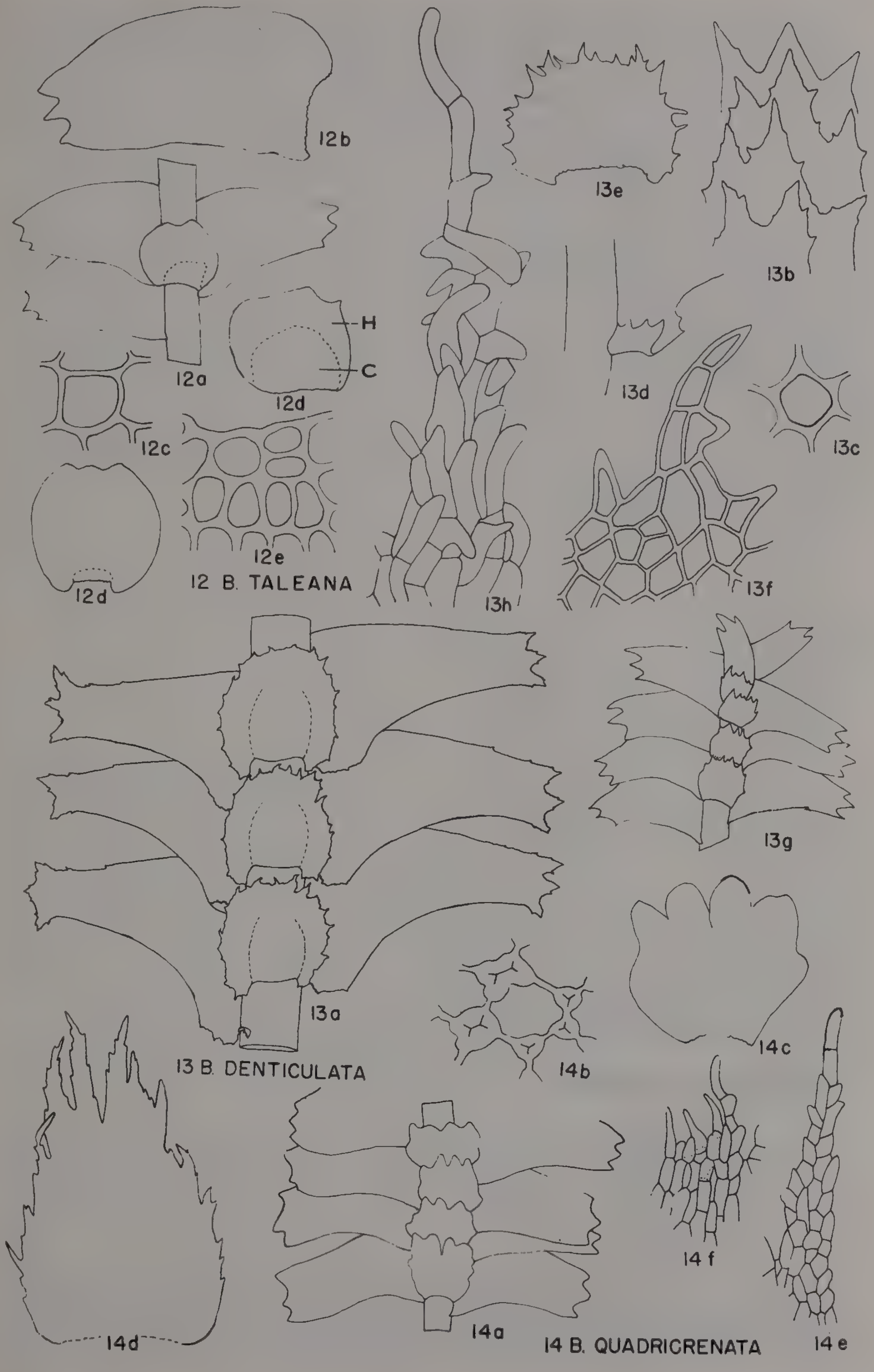
13. Bazzania denticulata (Lindenberg & Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum denticulatum Lindenberg & Gottsche in G. L. & N. Syn Hep. 718. 1847.
Mastigobryum planiusculum Lindenberg & Gottsche in G. L. & N. Syn. Hep. 718. 1847.
Bazzania planiuscula Trevisan, Mem. Ist. Lomb. 13: 414. 1877. Non *B. planiuscula* Spruce.
Bazzania rusbyi Spruce, Mem. Torrey Club 1: *129. 1890.*

FIG. 12. *Bazzania taleana.* 12 a. Stem, ventral view, × 15. 12 b. Leaf, × 30. 12 c. Leaf-cell, × 400. 12 d. Underleaves, × 30; C, chlorophyllose cells, H, hyaline area. 12 e. Cells of the upper margin of an underleaf, × 310.

FIG. 13. *B. denticulata.* 13 a. Stem, ventral view, × 15. 13 b. Apices of leaves, × 38. 13 c. Leaf-cell, × 400. 13 d. Appendiculate, saccate ventral auricle of the leaf, × 38. 13 e. Underleaf, × 25. 13 f. Cells from the upper margin of an underleaf, × 180. 13 g. Another stem, ventral view, × 10. 13 h. One of the laciniae of an innermost female bract, × 350.

FIG. 14. *B. quadricrenata.* 14 a. Stem, ventral view, × 15. 14 b. Leaf-cell, × 400. 14 c. An underleaf, × 30. 14 d. A female bract of the innermost series, × 30. 14 e. A lacinia of this bract, × 90. 14 f. Portion of the perianth-mouth, × 90.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12 B. TALEANA

13 B. DENTICULATA

14 B. QUADRICRENATA

Plants of medium size to robust, light green becoming brownish-green, in mats; stems stout, 5–10 cm long, with leaves to 3.5 mm broad, prostrate; lateral branches frequent, 5 mm or more apart, diverging at a wide angle; flagelliform branches numerous, short. Line of leaf insertion curved in the upper part. Leaves imbricate, plane, asymmetrically ovate, the margins entire to coarsely spinose-dentate in the upper part, the ventral base often dilated, auriculate with a serrate to dentate or crenulate or entire margin and folded back to form a sac, these better developed on one side of the stem than the other, 1.5–2.5 mm long, to 1 mm broad at the base, narrowing to the sharply tridentate apex; teeth large, spreading, six to eight cells long, five to seven cells broad at the base, the margins entire to coarsely spinose and dentate; leaf-cells uniformly thin-walled, the lumina rounded; cells of the apical region averaging 20 μ, the cuticle faintly verruculose. Underleaves approximate to imbricate, squarrose, subquadrate, broader than the stem, not connate with the leaves, 0.5–1.0 mm long, 0.6–0.9 mm wide, the margin variously toothed with long narrow, often branched teeth or spines. Female branches occasional, the innermost series of bracts large, ovate-lanceolate, divided to one-third their length into usually four dentate-ciliate laciniae, the lateral margins dentate to short-ciliate. Male branches and perianths not seen. Fig. 13, a–h.

Habitat: In mountain forests among mosses and on logs and tree bases.

JAMAICA: Cinchona, *Earle,* (YU); John Crow Peak, *Maxon & Killip 989* (NY); Morce's Gap, *Evans 29* (YU); s.l., *Sherring 7* (BM).

MEXICO: Oaxaca, *Liebmann 298* (type G, isotype FH), *Liebmann 295b,* type of *M. planiusculum* (G).

BRAZIL: Caraça, *Wainio 46* p.p. (G).

PERU: Cuzco: La Convencion, 1800 m, *Bues 1160* (NY); St. Gavan, *Lechler* (G).

BOLIVIA: Yungas, *Rusby 3029,* type of *B. rusbyi* (NY).

There is considerable variation in the leaves of plants from different areas. The outer margins and the teeth may be entire, crenulate, serrate and dentate or spinose. The ventral auricles are always poorly developed on leaves in which the outer margins are scarcely crenulate or serrate, while in leaves with coarsely dentate teeth, the auricles are conspicuous, long with a conspicuously serrate-dentate margin, and often folded back, forming a sac. Such ventral auricles and sacs were best developed on the plants from Peru, collected by *Bues.* They were also present in some of the plants from Jamaica, but were not so large or so well developed. Large auricles may be conspicuous on the row of leaves on one side of the stem and scarcely developed on the row of leaves opposite. Such sacs are not developed in any other American species of *Bazzania.*

14. Bazzania quadricrenata (Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum quadricrenatum Gottsche in Stephani, Hedwigia 25: *206. pl. 1. f. 1–4.* 1886.

Mastigobryum quadricrenatum forma *paupercula* G. A. Lindberg, Hedwigia 25: 206. 1886. (nomen nudum.)

Mastigobryum martianum G. A. Lindberg (nomen nudum). Non *M. martianum* Gottsche in Stephani, 1886.

Plants of medium size to large, olive-green to brownish-green, becoming brown; stems to 5 cm or more long, with leaves to 3.5 mm broad, prostrate to suberect; lateral branches frequent, mostly 5 mm apart, diverging at a wide angle; flagelliform branches frequent. Leaf insertion curved in its upper part.

Leaves imbricate, plane to deflexed, asymmetrically ovate to oblong-ovate, nearly straight, 1.5–2.0 mm long, 0.8–1 mm broad at the base, narrowed a little to the transversely truncate, irregularly tridentate apex; teeth mostly large, acute, four to six cells long and broad, the margins entire; leaf-cells thin-walled, the trigones large, with bulging sides, often coalesced, the lumina angular-rounded to stellate, the cuticle slightly verruculose; cells of the apical region 22 × 22 μ. Underleaves approximate to imbricate, subquadrate, broader than the stem, mostly 0.56 mm long × 0.7 mm broad, the lateral margins deeply lobed, the apex distinctly four-lobed, the lobes rounded, mostly three to eight cells long, six to eight cells broad, a slime papilla usually present at the tip of each lobe. Male branches several on a stem, the bracts and bracteoles round-quadrate, bifid or trifid; antheridia occurring singly. Female branches occasional, the bracts of the intermediate and innermost series long-ovate, divided to one-fourth their length into usually three, long, serrulate laciniae. Perianths mostly 5 mm long, the mouth ciliate to laciniate. Fig. 14, a–f.

Habitat: On trees in forested areas.

JAMAICA: Fairy Glade, *M. Farr 774* (IJ); summit of High Peak, *M. Farr 907, 911,* p.p., *914* (IJ); John Crow Peak, *Maxon 1240* (YU); slope of Mossman's Peak, *M. Farr 728, 729, 747* (IJ); Morce's Gap, *Evans 465* (YU); New Haven Gap, *M. Farr 928* p.p. (IJ); slope of Mt. Horeb, *M. Farr 950* (IJ).

PUERTO RICO: s.l., *Pagán 283* (NY).

GUADELOUPE: s.l., *l'Herminier* (type G).

GUATEMALA: Pitoreal, *Sharp 2776b, 2781* (TENN).

TRINIDAD: Long Stretch, *Broadway 6872* (BM).

COLOMBIA: Río Apaporis, Raudal Yayacapí, *Schultes, Cabrera & Bell 15441* (FH); Río Vaupés, *Schultes & Cabrera 13856* (FH).

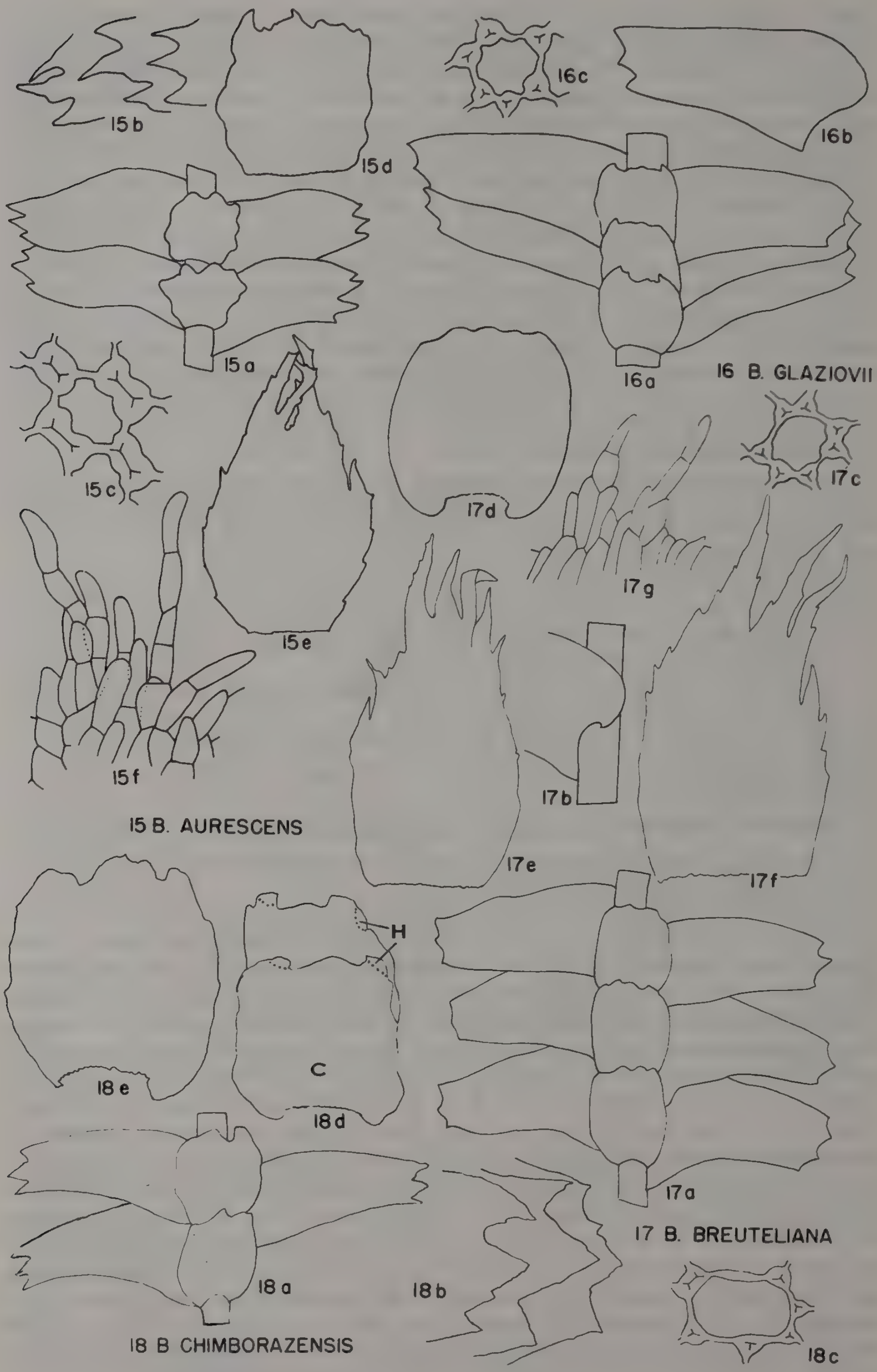
BRAZIL: Caldas, *G. A. Lindberg,* type of *M. martianum* Lindberg and *f. paupercula* Lindberg (G, isotype NY).

VENEZUELA: s.l., *Korthals* (G).

15. Bazzania aurescens Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 374. 1885.

Mastigobryum aurescens Stephani, Spec. Hep. **3**: 507. 1908.
Bazzania hookeri var. *Spruce* ms., *Hepat. Spruc.*

Plants of medium size to large, greenish-brown, becoming dark yellow-brown; stems slender, 6 cm or more in length, with leaves to 3.5 mm broad, prostrate to ascending; lateral branches infrequent, diverging at a wide angle; flagelliform branches frequent, long. Line of leaf insertion curved in its upper part. Leaves approximate to subimbricate, plane, becoming deflexed when dry, asymetrically narrow-ovate to oblong, spreading, 1.5–2.0 mm long, 0.7–0.8 mm broad at the base, narrowed a little to the transversely truncate, tridentate apex; teeth irregular, three to six cells long and broad, acute to acuminate, the sinuses lunulate, the margins usually crenulate; leaf-cells thin-walled, the lumina angular-rounded to stellate, the trigones large with convex sides, often becoming coalesced, the cuticle faintly verruculose; cells of the apical region 24–36 μ long. Underleaves imbricate, subquadrate in outline, broader than the stem, 0.6–0.7 mm long and broad, the apex irregularly incised with unequal teeth and lobes. Female branches occasional, the bracts and bracteoles of the innermost series long, ovate, divided to one-sixth or one-fourth of their length into three ciliate laciniae, the lateral margins dentate to short-ciliate. Perianth-mouth fringed with long cilia. Male branches not seen. Fig. 15, a–f.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18 c

15 B. AURESCENS

16 B. GLAZIOVII

17 B. BREUTELIANA

18 B CHIMBORAZENSIS

Habitat: On shady rocky slopes, logs and trunks of trees in mountain forests.

COLOMBIA: Río Apaporis, *Schultes & Cabrera 12552, 16582* (FH); Río Caquetá, La Pedrera, *Schultes, Cabrera & Bell 17816* (FH).

VENEZUELA: Hacienda Cura near Valencia, *Alston 6143* (BM); Playa Alta, *Maguire, Cowan & Wurdack 29398* (NY); s.l., *Fendler* (as *M. scutigerum*, poor) (FH).

BRITISH GUIANA: Bartica, *Tutin 223* (BM).

ECUADOR: V. Bomboiza, Gualiquiza, *Allioni, Bryol. Ecuador no. 353* (G).

BRAZIL: Apiahy, *Puiggari 108* (as *M. scutigerum*), *761* (as *M. arcuatum*) (G); S. Paulo: Alto da Serra, *Schiffner 1063* (W); Campo Grande, *Schiffner 1056* (W); near Santos, *Schiffner 1056* (W).

PERU: Mt. Guayrapurina, *Spruce, Hep. Spruc.* (isotypes FH, G).

16. **Bazzania glaziovii** (Gottsche) Fulford, *Bazzania* Cent. S. Am., 65. *f. 21.* 1946.

Mastigobryum glaziovii Gottsche in Stephani, Hedwigia **25**: 8. *pl. 4, f. 1–2.* 1886.

Plants of medium size to large, dark green, becoming brown; stems stout, to 5 cm or more in length, with leaves to 4 cm broad, prostrate to suberect; lateral branches frequent, 1 cm or more apart, diverging at a wide angle; flagelliform branches frequent. Line of leaf insertion curved in the upper part. Leaves imbricate, plane to deflexed, asymmetrically ovate, spreading, 1.8–2.3 mm long, 1 mm broad at the base, narrowed to the obliquely truncate, irregularly tridentate apex; teeth broad, three to five cells high, four to seven cells wide at the base, the sinuses lunulate, the margins entire: leaf-cells thin-walled, the lumina angular-rounded, the trigones large, distinct, often becoming coalesced, the cuticle smooth to faintly verruculose; cells of the apical portion mostly 20–24 μ; underleaves imbricate, subquadrate, broader than the stem, 0.7–0.85 mm long, 0.6–0.7 mm wide, the lateral margins often lobed, the apex usually with a short, incurved tooth at either end, and undulate to lobed between. Sexual branches not seen. Fig. 16, a–c.

Habitat: Over rocks.

COLOMBIA: Río Kuduyarí, *Schultes, Cabrera & Bell 14302* (FH); Río Piraparana, *Schultes, Cabrera & Bell 15899* (FH).

BRITISH GUIANA: Turkeit, *Lutz* (NY).

BRAZIL: Rio de Janeiro, *Glaziou* (type G, isotype FH); Quimado, *de Rossmalen 277* (G); Apiahy, *Schiffner 2319* (W); S. Paulo: near Rais da Serra, *Schiffner 930* (W).

17. **Bazzania breuteliana** (Lindenberg & Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum breutelianum Lindenberg & Gottsche in G. L. & N. Syn. Hep. 226. 1845.
Bazzania vincentina var. *subrectifolia* Spruce ms. p.p.

FIG. 15. *Bazzania aurescens.* 15 a. Stem, ventral view, × 15. 15 b. Apices of leaves, × 30. 15 c. Leaf-cell, × 400. 15 d. Underleaf, × 30. 15 e. A female bract of the innermost series, × 30. 15 f. Cells of the perianth-mouth, × 100.

FIG. 16. *B. glaziovii.* 16 a. Stem, ventral view, × 15. 16 b. Leaf, × 15. 16 c. Leaf-cell, × 400.

FIG. 17. *B. breuteliana.* 17 a. Stem, ventral view, × 15. 17 b. Dorsal base of a leaf on a stem, × 30. 17 c. Leaf-cell, × 400. 17 d. Underleaf, × 30. 17 e, f. Female bracts of the innermost series, × 30. 17 g. Cells of the perianth-mouth, × 100.

FIG. 18. *B. chimborazensis.* 18 a. Stem, ventral view, × 15. 18 b. Apices of leaves, × 40. 18 c. Leaf-cell, × 350. 18 d. Underleaves, × 40; C, chlorophyllose cells, H, hyaline cells. 18 e. Underleaf, × 60.

Mastigobryum portoricense Hampe & Gottsche, Linnaea **25**: 348. 1852.
Mastigobryum cuervi Gottsche, Ann. Sci. Nat. Bot. V. **1**: 141. 1864.
Mastigobryum sylvaticum Gottsche, Husnot, Hep. Exsicc. (nomen nudum.) non *M. sylvaticum* Stephani.
Bazzania viridissima Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 375. 1885.
Mastigobryum viridissimum Stephani, Spec. Hep. **3**: 522. 1909.
Mastigobryum uleanum Stephani, Spec. Hep. **3**: 529. 1909.
Mastigobryum hariotii Stephani in Herzog, Biblioth. Bot. **87**: 224. *f. 164, d-e.* 1916.
Bazzania portoricensis var. *pycnodictyon* Herzog, Rev. Bryol. Lichénol. **11**: 19. 1938.

Plants large, in deep tufts or mats, olive-green to brownish-green, pigmented with brown; stems to 10 cm or more long, with leaves to 4.5 mm broad, prostrate to suberect; lateral branches frequent, mostly more than 5 mm apart, diverging at a wide angle; flagelliform branches frequent. Line of leaf insertion curved in its upper part, the dorsal margin recurved forming a short hook. Leaves distant to imbricate, plane to deflexed, asymmetrically ovate, oblong on robust plants, spreading, often becoming a little falcate, 1.5–2.6 mm long, 0.8–1 mm broad at the base, narrowed a little to the transversely truncate, unequally tridentate apex; teeth large, acute, two to eight cells long and broad, occasionally obscure, the sinuses deep-acute to lunulate, the margins entire; leaf-cells tending to be in rows, thin-walled, the lumina angular-rounded, the trigones small, conspicuous, the cuticle verruculose; cells of the apical region $20 \times 20\,\mu$. Underleaves distant to imbricate, subquadrate to elongate, much broader than the stem, 0.8–1 mm long, 0.65–1 mm wide, the lateral margins convex, the base cordate, the apex usually 2–4-lobed, the lobes broad, rounded. Female branches occasional, the bracts and bracteoles of the innermost series ovate, divided to one-third or one-fourth of their length into three or four long segments, the margins serrulate to short-ciliate or dentate. Perianth long, the mouth short-ciliate. Male branches and sporophyte not seen. Fig. 17, a–g.

Habitat: On logs, tree bases and branches in wooded areas.

CUBA: Oriente, *Shafer 9116* (YU, NY).

JAMAICA: Sir John's Peak, *Harris 11, 135a* (NY); Morce's Gap, *Evans 41, 44, 390* (YU), *Bengry* (IJ); summit of Sugar Loaf Peak, *M. Farr 1092* (IJ); s.l., *Webster* (NY).

PUERTO RICO: near Adjuntas, *Sintenis H33, H87* (G), *Sintenis 92* (as *B. wrightii*) (NY); Alto de la Bandera, *Britton & Marble 2175* (NY); Canovanas, *Pagán 291* (NY); El Yunque, *Evans 11, 66, 132* (YU, NY), P. R. College Agr. 2792 (NY), *Steere 4038, 4309, 4057, 4208, 4297;* Luquillo Mountains, *E. G. Britton 7753* (NY), *Sintenis H18, H33* (G); Mt. Britton, *Jones 10976* (FH); Sierra Naguabo, *Shafer a, 3306, 3455, 3729* (NY), *E. G. Britton & Hess* 2291 (NY), *Sintenis H3, H123* (G); s.l., *Schwanecke,* type of *M. portoricense* (NY); s.l., *Schwanecke 23, 728, 1161* (G).

ST. KITTS: Mt. Misery, *Breutel* (type NY, isotype G), *Britton & Cowell 783* (NY), without collector *275* (G).

GUADELOUPE: Morne Hirondelle, *Duss 282* (NY); s.l., *Husnot,* type of *M. sylvaticum* Gottsche (FH); s.l., *l'Herminier* (as *M. sylvaticum*) (G); s.l., *l'Herminier, 114* (G).

DOMINICA: Sylva ad Laudat, *Eggers* (G); s.l., *Eggers* (G); Morne Anglais, *Elliott 4878* (BM); Morne Diablotin, *Elliott 690c* p.p., *2146, 2212* (BM); Morne Trois Pitons, *Elliott 2279, 2315* (BM): summit of Coulisbon, *Elliott 1894a* (BM); Roseau Lake, *Elliott 1167* (BM) s.l., *Elliott 1108, 1611, 1643* (G).

DOMINICAN REPUBLIC: Pacificador, *Abby 2061a, 2063, 2126* (YU).

MARTINIQUE: Mt. Pelée, *Duss 126, 127, 347* (NY); s.l., *Duss 205* (G).

TRINIDAD: Mt. Aripo, *Greig-Smith 1450* (IJ).

MEXICO: Oaxaca, *Liebmann 255 a, b,* mixed with *M. taleanum* (FH, G), *Sharp 5702* (TENN).

GUATEMALA: Nebaj, *Sharp 2529* (TENN); *Steyermark 38831* (F); Vulcán de Pacaya, *Standley 80537* (F).

COSTA RICA: Alto del Pito: Mt. San Marcas de Dotam, 1400 m, *Tonduz 3009* (G), *Tonduz 11618* (NY); La Estrella, *Standley 39106, 39117, 39403* (US); El Muñeco, *Standley 51338, 50887*, type of *B. portoricensis* var. *pycnodictyon* (US); Santa Clara, Cartago, *R. Torres 220–1* (F).

COLOMBIA: Bogotá, *Cuervo*, type of *M. cuervi* (B); Antioquia: s.l., *Wallis* (as *M. bogotense*) (G); Río Kananari, *Schultes & Cabrera 13117* (FH); Villavicencio, *Alston 7583* (BM); Norte de Santander, *Cuatrecasas, Schultes & Smith 12448t* (US); Dep. del Valle, *Cuatrecasas 14951b* (US); s.l., *Wallace* (NY).

VENEZUELA: near Maturin, *Alston 5583* (BM); Estado Bolívar, Chimantá Massif, *Steyermark 75578* (NY).

FRENCH GUIANA: Cayenne, *Perrottet* (as *M. stoloniferum*) (G); s.l., *Leprieur 292* (as *M. stoloniferum*) (G).

ECUADOR: Gualiquiza, *Allioni* (ex Hb. Levier 6574, 6575, as *M. lindigii*) (G); Oriente-V. Bomboiza, *Allioni 343* (as *M. cuervi*) (G): Tungurahua, *Spruce, Hep. Spruc.* (as *B. vincentina* var. *subrectifolia*), p.p. (NY).

BRAZIL: Manáos, *Ule*, the type of *M. uleanum* (FH); s.l., *Sellow* (as *M. martianum*) (FH, G); St. Catarina, *Reitz 2.137a, 2.556* (HBR); s.l., *Ule 327* (as *M. lindigii*) (G); S. Paulo: Alto da Serra, *Schiffner 1064* (W); Brasso Grande, *Schiffner 1313, 1547* (W); s.l., *Jack* (as *M. brasiliense*) (G); Petrópolis, *Döring* (G).

PERU: Campana, *Spruce*, isotype of *B. viridissima* (FH); Tanatara, *Lechler* (as *M. chilense* and *M. scutigerum β lechleri*) (G).

BOLIVIA: Casapi, *Mathews* (FH, NY); Comarapa, *Herzog*, type of *M. hariotii* (L); Yungas, *Troll 89* (Hb. Herzog).

18. **Bazzania chimborazensis** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 376. 1885.

Mastigobryum chimborazense Stephani, Spec. Hep. 3: 527. 1909.

Plants robust, yellow-green becoming olive-green to brown; stems to 10 cm or more long, with leaves 4–5 mm broad; lateral branches infrequent, diverging at a wide angle. Rhizoids abundant from the scale leaves of the flagelliform branches. Line of leaf insertion curved in the upper part, the end recurved, hook-form. Leaves spreading, imbricate, plane to deflexed, asymmetric, oblong, somewhat decurved, averaging 2.25 mm long, to 1.6 mm broad at the base, narrowed a little to the irregularly 3- or occasionally 4-toothed apex; teeth mostly large, acute, three to eight cells long, three to eight cells broad at the base, the sinuses acute, the margins obscurely serrate; leaf-cells thin-walled, the trigones small with convex sides, the lumina angular-rounded, the cuticle verruculose; cells of the apical portion 18–22 × 18 μ. Underleaves large, much broader than the stem, imbricate, 1 mm or more long and 1 mm broad, attached in a straight or slightly curved line, the base rounded to subcordate, the lateral margins sinuate with broad lobes, the apex lobed and toothed, very often with some cells of the margin hyaline, cells as in the leaf. Male and female inflorescences and sporophyte not seen. Fig. 18, a–e.

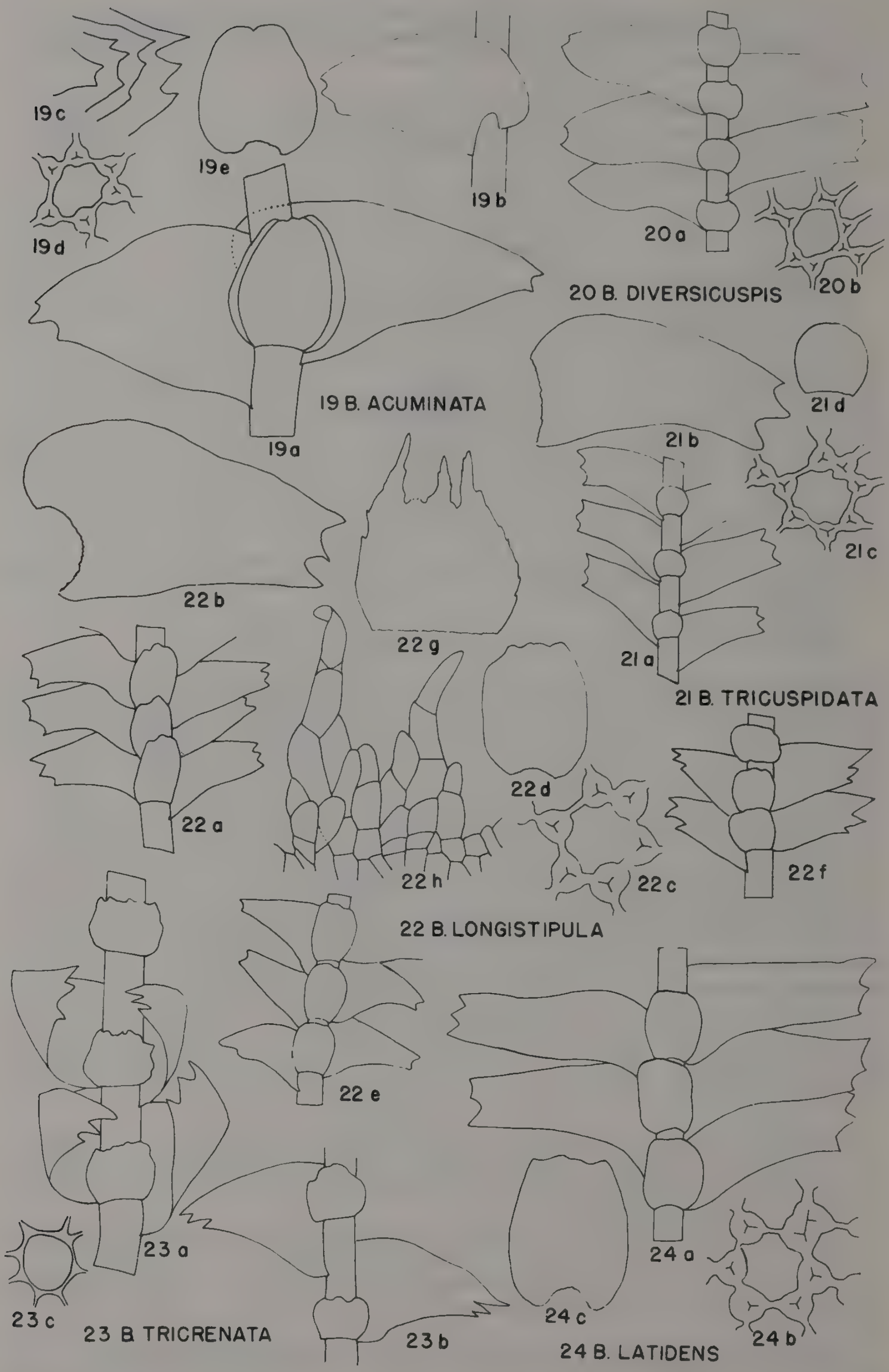
Habitat: In tufts or mats on tree trunks and branches and on logs in forests.

COLOMBIA: Dep. del Valle: Rio Cajambre, *Cuatrecasas 17019B, 17024-B, 17059-B* (US); Cordillera Occid., *Cuatrecasas 22129-B*.

BRAZIL: Manáos, *Spruce, Hep. Spruc.* as *B. brasiliensis* (NY); Minas Gerais: Caldas, *Mosén* (G); S. Paulo: Itapecerica, Brasso Grande, *Schiffner 1320* (W).

ECUADOR: Andes Quitenses, Mt. Chimborazo, 1300 m, *Spruce Hep. Spruc.* [no. 113], (isotypes G, NY), other packets, Chimborazo, *Spruce* (G).

The species is similar to robust plants of *B. breuteliana* in general aspect. It may be distinguished by its characteristically irregularly lobed and toothed


19 c
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23 c
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24 c
24 b

19 B. ACUMINATA

20 B. DIVERSICUSPIS

21 B. TRICUSPIDATA

22 B. LONGISTIPULA

23 B. TRICRENATA

24 B. LATIDENS

apical margins of the underleaves with a few hyaline cells, and the more or less serrate margins of the teeth of the leaves.

19. Bazzania acuminata (Lindenberg & Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum acuminatum Lindenberg & Gottsche in G. L. & N. Syn. Hep. 719. 1847.
Mastigobryum orizabense Gottsche, Mex. Leberm. 130. 1863.
Mastigobryum müllerianum Gottsche, Mex. Leberm. 129. 1863.

Plants of medium size, olive-green, deeply pigmented with brown; stems to 5 cm long, with leaves to 2.5 or 3 mm broad; lateral branches frequent, diverging at an acute angle; flagelliform branches frequent, long. Line of leaf insertion curved in its upper half, the dorsal end curved downward, forming a short hook. Leaves distant to imbricate, spreading, strongly deflexed when dry, asymmetrically and broadly ovate, 1.5–2.0 mm long, 0.8–1 mm broad at the base, narrowed to the usually obliquely truncate, unequally tridentate apex; teeth acute, two to five cells long and broad, the sinuses lunulate, the margins entire; leaf-cells thin-walled, the trigones conspicuous, with bulging sides, sometimes coalesced, the lumina angular-rounded, the cuticle verruculose; cells of the apical region 18 × 18 μ. Underleaves distant to approximate, orbicular, broader than the stem, 0.50–0.56 mm long, 0.45–0.52 mm broad, the lateral margins entire, strongly recurved, the apex entire, emarginate, undulate. Sexual branches not seen. Fig. 19, a–e.

Habitat: Not given.

MEXICO: Oaxaca, *Liebmann 176b* (type G); Vera Cruz: Orizaba, *Müller 159*, type of *M. orizabense* (G); *Müller 2361*, type of *M. müllerianum* (NY); Chiapas: Mapastepec, *Sharp 4558* (TENN).

VENEZUELA: Caracas, *Burchel* (NY).

20. Bazzania diversicuspis Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 373. 1885.

Mastigobryum diversicuspe Stephani, Spec. Hep. 3: 432. 1908.
Mastigobryum venezuelanum Stephani, Spec. Hep. 3: 530. 1909. Non *M. venezuelanum* Molkenboer in Sande-Lacosta.

Plants delicate, dull green to light brown; stems slender, to 4 or 5 cm long, with leaves to 3 mm broad, prostrate; lateral branches 1 cm or more apart, diverging at a wide angle; flagelliform branches frequent, long. Leaf insertion little curved in the upper part. Leaves spreading to ascendent, approximate to imbricate, straight, asymmetrically ovate, to 1 mm long, 0.48 mm broad at the base, narrowed somewhat to the acute, rounded-acute, or transversely truncate,

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FIG. 19. *Bazzania acuminata.* 19 a. Stem, ventral view, × 30. 19 b. Stem and leaf, dorsal view, × 15. 19 c. Apices of leaves, × 30. 19 d. Leaf-cell, × 350. 19 e. Underleaf, × 30.

FIG. 20. *B. diversicuspis.* 20 a. Stem, ventral view, × 15. 20 b. Leaf-cell, × 350.

FIG. 21. *B. tricuspidata.* 21 a. Stem, ventral view, × 15. 21 b. Leaf, × 30. 21 c. Leaf-cell, × 400. 21 d. Underleaf.

FIG. 22. *B. longistipula.* 22 a. Stem, ventral view, × 12. 22b. Leaf, × 30. 22 c. Leaf-cell, × 350. 22 d. Underleaf, × 30. 22 e. Another stem, ventral view, × 12. 22 f. Another stem, ventral view, × 15. 22 g. A female bract of the innermost series (immature), × 30. 22b. Portion of the perianth-mouth, × 260.

FIG. 23. *B. tricrenata.* 23 a, b. Stems, ventral view, × 30. 23 c. Leaf-cell, × 350.

FIG. 24. *B. latidens.* 24 a. Stem, ventral view, × 15. 24 b. Leaf-cell, × 400. 24 c. Underleaf, × 30.

obscurely bi- or tridentate apex; teeth acute, two to four cells high, three to eight cells broad at the base, the margins entire; leaf-cells more or less quadrate in outline, thin-walled, the trigones small, conspicuous, seldom becoming coalesced, the cuticle verruculose; cells of the apical region mostly 17 × 17 μ. Underleaves distant to approximate, attached in a straight line, subquadrate in outline, a little broader than the stem, 0.28–0.36 mm long and broad, the apex straight, undulate, 2- to 4-lobed or occasionally with one or two short, sharp teeth. Male and female branches not seen. Fig. 20, a–b.

Habitat: In depressed mats or scattered among ferns.

TRINIDAD: Without locality or collector (NY).

BRAZIL: Tauaú near Pará, *Spruce, Hepat. Spruc.* (isotypes G, NY).

VENEZUELA: s.l., *Fendler,* type of *M. venezuelanum* (G).

In general appearance the species is similar to *B. affinis.* It differs, however, in that the underleaves are not hyaline except for occasional marginal cells, and trigones are conspicuous.

21. **Bazzania tricuspidata** (Stephani) Fulford, *Bazzania* Cent. S. Am. 79. *f. 27.* 1946.

Mastigobryum tricuspidatum Stephani, Spec. Hep. 3: 148. 1908.

Plants small, golden-brown, becoming darker; stems slender, 3 cm or more in length, with leaves to 2 mm broad; lateral branches mostly more than 1 cm apart, diverging at a wide angle; flagelliform branches occasional. Line of leaf insertion little curved in its upper part. Leaves distant, spreading, ascendent, strongly deflexed when dry, asymmetrically ovate, mostly 1 mm long, 0.5 mm broad at the base, narrowed a little to the broad, transversely truncate, tridentate apex; teeth acute, three to six cells long, three to five cells broad at the base, the margins entire; leaf-cells thin-walled, the lumina angular-rounded, the trigones conspicuous, sometimes becoming coalesced, the cuticle faintly verruculose; the cells of the apical region mostly 24 × 24 μ. Underleaves distant, round-quadrate, entire, scarcely broader than the stem, 0.28 mm long and broad, the margins rounded, the cells 20–24 μ long, 16 μ broad, the walls uniformly thickened, especially along the margin. Sexual branches not seen. Fig. 21, a–d.

Habitat: On bark of rotten logs, dark gorge of Mist Forest (Schultes).

COLOMBIA: Cordillera La Macarena, *Schultes 11254* (FH).

BRITISH GUIANA: s.l., *Quelch* (type G, isotype FH).

22. **Bazzania longistipula** (Lindenberg) Trevisan, Mem. Ist. Lomb. **13**: 415. 1877.

Mastigobryum longistipulum Lindenberg, in G. L. & N. Syn Hep. 228. 1845.

Mastigobryum consanguineum Hampe & Lindenberg in G. L. & N. Syn. Hep. 717. 1845.

Bazzania consanguinea Trevisan, Mem. Ist. Lomb. 13: 414. 1877.

Mastigobryum consanguineum var. *brachyphyllum* Stephani, Hedwigia 24: 217. *pl. 2, f. 2.* 1885.

Mastigobryum brachyphyllum Gottsche in Stephani, Hedwigia 24: *217.* 1885.

Bazzania teretiuscula Spruce, Trans. Proc. Bot. Soc. Edinb. 15: 375. 1885. Non *M. teretiusculum* Lindenberg & Gottsche.

Bazzania decidua Spruce, Trans. Proc. Bot. Soc. Edinb. 15: 372. 1885.

Bazzania longistipula var. Spruce ms., *Hepat. Spruc.*

Bazzania longistipula var. *polymastix* Spruce ms., *Hepat. Spruc.*

Mastigobryum elegantulum Gottsche, Ann. Sci. Nat. V. Bot. 1: 141. 1864 (nomen nudum); in Stephani Hedwigia 25: 5. *pl. 2. f. 1–3.* 1886. *Non M. elegantulum* De Notaris, 1874.

Mastigobryum paludosum Gottsche in Stephani, Hedwigia **25**: 243. 1886. (nomen nudum.)
Mastigobryum phyllobolum Gottsche in Stephani, Hedwigia **25**: 243. 1886. Non *Bazzania phyllobola* Spruce.
Bazzania krugiana Stephani, Hedwigia **27**: 300. *pl. 13. f. 40.* 1888.
Mastigobryum saxatile Gottsche in Stephani, Spec. Hep. **3**: *470*. 1908. (nomen nudum.)
Mastigobryum krugianum Stephani, Spec. Hep. **3**: 447. 1908.
Mastigobryum deciduum Stephani, Spec. Hep. **3**: 467. 1909.
Mastigobryum hansenii Stephani, Spec. Hep. **3**: 467. 1909.
Mastigobryum puiggarii Stephani, Spec. Hep. **3**: 472. 1909.
Mastigobryum colombicum Stephani, Spec. Hep. **6**: 458. 1924.

Plants olive-green to golden-brown or dark brown; stems slender to 6 cm or more long, with leaves 1.5–3 mm broad, prostrate to ascending or erect; lateral branches 0.5–1.5 cm apart, diverging at a wide angle; flagelliform branches frequent, long. Leaf insertion curved in the upper part. Leaves approximate to densely imbricate, ascendent, often deflexed and becoming wrapped around the stem when dry, asymmetrically ovate, 0.8–2 mm long, mostly 0.5–1 mm broad at the base, narrowed to the obliquely truncate, tridentate apex, in slender forms sometimes bidentate or acute; teeth acute, two to six cells long, two to six cells broad at the base, the acroscopic tooth the longest, the margins straight to undulate; leaf-cells thin-walled, the lumina angular-rounded, the trigones conspicuous, with convex sides, often becoming coalesced, the cuticle faintly verruculose; cells of the apical portion averaging 24 × 24 μ, or rarely to 30 μ. Underleaves distant to imbricate, quadrate to oblong, as broad as or broader than the stem, 0.35–1 mm long × 0.35–0.7 mm wide, often squarrose, the apex straight to rounded-entire, or faintly 2–4-undulate or -lobed. Female branches occasional, the bracts and bracteoles of the innermost series ovate, large, divided to one-third or one-fourth of their length into usually three, dentate to ciliate segments, the lateral margins dentate to ciliate, the cells 45–72 μ long × 18 μ wide. Perianth long, the mouth laciniate, with short, crenulate laciniae, mostly three to five cells long. Males branches and sporophyte not seen. Fig. 22, a–h.

Habitat: Common in mats, deep tufts or scattered among other bryophytes, over logs, tree bases, rocks and soil, in wooded, elevated regions.

JAMAICA: Summit of Blue Mountain Peak, *Maxon & Killip 1104* (YU, NY); Blue Mountain Peak, 6500–7525 ft, *Underwood 1784* (NY), *Lewis 96* p.p. (IJ), *Bengry 102* p.p. (IJ); summit of East Peak, *Powell & M. Farr 1026, 1028, 1029, 1030, 1033, 1037* (IJ); summit of High Peak, *M. Farr 901, 911* p.p, *912, 921, 922* (IJ); Moree's Gap, *Bengry 305* p.p (IJ); e. slope, Mossman's Peak, *M. Farr 727* (IJ); New Haven Gap, *Patterson* (Hb. Fulford); Sir John's Peak, *E. G. Britton 1197* (NY); between Sir John's and High Peak, *Lewis 70b* (IJ), *Bengry 102* (IJ); summit of Sugar Loaf, *M. Farr 1080, 1084, 1085, 1087, 1091, 1093* (IJ); s.l., *Harris* (NY); s.l., *Hansen*, isotype of *M. hansenii* (FH); s.l., *Rehder*, type of *M. elegantulum* Gottsche (B, isotype FH); s.l., *Orcutt 2936, 2937, 2946, 2977, 5322, 5591* (BM); s.l., *Hansen* (as *M. portoricense*) (G).

DOMINICAN REPUBLIC (Santo Domingo): s.l., *Eggers*, type of *B. krugiana* (B, isotype FH).

PUERTO RICO: Luquillo Mountains, *Steere 4359, 4392, 5539;* Mt. Britton, *Steere 4246, 4268;* Maricao, *Steere 5583;* Rio Sabana Trail, *Steere 6205* (Hb. Fulford); Rio de Maricao, *E. G. Britton 2682* (YU).

GUADELOUPE: Matonba, *Duss 211* (NY); Soufrière, *Duss 136* (NY); s.l., ex Hb. Gottsche, isotype of *M. paludosum* (FH); s.l., ex Hb. Gottsche, isotype of *M. saxatile* (FH); s.l., *Parker* (NY); s.l., 760 m, *Duss 211* (G).

DOMINICA: summit of Caulisbon, *Elliott 1872a, 1918b* (BM); Morne Micotrin, *Elliott 26b* p.p., *32a, 1129a* p.p. (BM); Roseau Valley, *Elliott 31b* (BM); s.l., *Elliott 1617* (G).

ST. VINCENT: s.l., *Guilding* (NY): s.l., *Hooker* Hb.; (type G, isotypes FH, W).

MEXICO: Chiapas: Montebello, *Sharp 3577* (TENN); Michoacan: Cerro Grande, *Frye & Frye 2782* (PH).

GUATEMALA: Pitoreal, *Sharp 2772* (TENN); Alta Verapaz, *Standley 90648* (F).

COLOMBIA: S. Merida: Sierra Nevada, *Moritz*, type of *M. consanguineum* (FH); Dep. Norte de Santander, Sarara, *Cuatrecasas, Schulte & Smith 12448cc, dd, E, L, N, O.* (US); s.l., *Irmscher 29*, type of *M. colombicum* (G); s.l., *Schlim* (as *M. scutigerum*) (G).

VENEZUELA: Caracas: Merida, 4500 ft, *Funck & Schlim 350 bis* (as *M. scutigerum*) (G); Cura, *Alston 6164* (BM); Cumbre, *Cowan & Wurdack 31326* (NY); Valencia, *Fendler* (as *M. scutigerum*) (G); s.l., *Fendler 30* (G).

BRITISH GUIANA: Roraima, *McConnell & Quelch 512* p.p. (as *M. deciduum f. etiolatum*) (G).

BRAZIL: Apiahy, *Puiggari 108, 648, 759a, 764, 781a, 882, 1115, Y* (as *M. scutigerum*) (G); *Puiggari 276a, 782c* (as *M. cuervi*) (G); Serra do Mar, *Dusén*, type of *M. puiggarii* (FH); Caraça, *Wainio* (as *M. scutigerum*) (G); Rio de Janeiro, *Schiffner 2275* (W); *Glaziou 7227b* (as *M. scutigerum*); Paraná, *Dusén 1886, 3899, 3916* (G); S. Paulo: Campo Grande, *Schiffner 458, 460, 461, 462, 463* p.p., *466* p.p., *468, 469, 470, 479* (W); Barra Mansa, *Schiffner 502, 1565, 1873,* (W); Alto da Serra, *Schiffner 1691* (W).

ECUADOR: Mt. Turguarahua, *Spruce, Hep. Spruc.*, type of *B. teretiuscula Spruce* (isotypes FH, NY); *Spruce, Hep. Spruc.*, type of *B. decidua* (isotype NY).

PERU: Mt. Campana, *Spruce* (G), *Spruce*, type of *B. longistipula* var. *polymastix* (isotype NY).

BOLIVIA: Yungas, *Jay* (YU).

23. Bazzania tricrenata (Wahlenberg) Trevisan Mem. Ist. Lomb. **13**: 414. 1877.

Jungermannia tricrenata Wahlenberg, Fl. Carpat. 364. 1814.

[The long synonymy for this species is given in works on Hepaticae of North America or of Europe.]

Plants filiform to medium size, olive-green, more or less pigmented with dark brown, often becoming reddish; stems slender, 2–8 cm long, with leaves to 2 mm wide, prostrate to ascending; branches 1 cm or more apart, diverging at an acute angle; flagelliform branches numerous, long. Line of insertion curved in the upper half. Leaves distant to imbricate, spreading to ascendent or curved around the stem, persistent, asymmetric, ovate-triangular, to 1 mm long, to 0.6 mm broad at the base, narrowing to the acute or obliquely truncate, 3-toothed (sometimes 2-toothed) apex, the acroscopic tooth longest; teeth two to six cells long, one or two to five cells broad at the base; leaf-cells thin-walled, the trigones small, the lumina rounded, the cuticle smooth to slightly verruculose; cells of the apical portion $20\text{–}26 \times 22\ \mu$. Underleaves distant to approximate, squarrose, broadly quadrate-orbicular, as wide as or wider than the stem, to 0.35 mm long, 0.45 mm wide, the apex usually undulate to four-lobed, the lateral margins undivided to occasionally irregularly lobed or toothed. Male and female branches and sporophytes not seen on the Central American material. Fig. 23, a–c.

Habitat: In mats on soil banks; also on soil, rocks, logs and tree trunks in woods in the northern hemisphere.

North America, Europe, Asia.

GUATEMALA: Chimaltenango: Cerro above Tecpán, 9300 ft, *Sharp 2582* (TENN).

The species is to be found in North America, from northern California northward to southern Alaska, and from northeastern Canada, south to North Carolina and west to eastern Kentucky and Tennessee.

This is the first record for this species south of the United States, and the first record for any northern species of *Bazzania* in Latin America. It becomes another in the list of examples of plants that has a discontinuous distribution that includes eastern (and western) North America and the Highlands of Mexico–Quatemala.

24. Bazzania latidens (Gottsche) Fulford, *Bazzania* Cent. S. Am. 88. *f. 30.* 1946.

Mastigobryum latidens Gottsche in Stephani, Hedwigia **25**: 134. *pl. 5. f. 7–9.* 1886.

Plants of medium size to large, golden-yellow to yellow-brown, tinged with red in the older portions; stems to 5 cm or more in length, with leaves to 4 mm broad; lateral branches frequent, 1 cm or more apart, diverging at a wide angle; flagelliform branches occasional. Line of leaf insertion curved in its upper half. Leaves subimbricate to imbricate, spreading, plane or deflexed, asymmetrically ovate to elongate, straight to ascendent, mostly 2 mm long, 0.8 broad at the base, narrowed a little to the scarcely obliquely truncate, tridentate apex; teeth mostly large, six to eight cells long, five to eight cells broad at the base, the margins entire; leaf-cells thin-walled, the lumina angular-rounded, the trigones conspicuous, with convex sides, sometimes becoming coalesced, the cuticle verruculose; cells of the apical region 20–24 μ. Underleaves approximate to imbricate, rectangular in outline, broader than the stem, 0.6–0.9 mm long, 0.55 mm broad, the lateral margins nearly straight, entire, the apex truncate, entire, undulate to slightly 2–4-lobed, the cells tending to be in rows, mostly 16–24 μ × 16 μ, the trigones conspicuous. Sexual branches not seen. Fig. 24, a–c.

Habitat: On rocks.

MEXICO: Cepecal, *Karsten 9* (G).
BRAZIL: s.l., *Glaziou 1792* (type G, isotype FH).

25. Bazzania longa (C. G. Nees) Trevisan, Mem. Ist. Lomb. **13**: 415. 1877.

Jungermannia longa C. G. Nees, Linnaea **6**: 623. 1831.
Jungermannia stolonifera Sieber, Pl. Crypt. Exsicc. no. 35, Linnaea **6**: 623. 1831. Non *J. stolonifera* Swartz.
Mastigobryum longum C. G. Nees in G. L. & N. Syn. Hep. 231. 1845.
Mastigobryum gottscheanum Lindenberg in G. L. & N. Syn. Hep. 224. 1845.
Bazzania gottscheana Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.
Mastigobryum speciosum Gottsche, *Husnot, Pl. Antilles* no. 213. 1868; Husnot, Rev. Bryol. **2**: 3. 1875 (nomen nudum); Gottsche in Stephani, Hedwigia **25**: 233. *pl. 1. f. 1–3. 1886.*
Mastigobryum subfalcatum Gottsche in Stephani, Hedwigia **25**: 234. *pl. 1. f. 4–6.* 1886.
Bazzania subfalcata Spruce, Jour. Linn. Soc. Bot. **30**: 356. 1895.
Mastigobryum tenue Stephani, Spec. Hep. **3**: 448. 1908.
Mastigobryum trinitatis Stephani, Spec. Hep. **6**: 483. 1924.

Plants of medium size to robust, dark green, becoming deep red-brown; stems stout, to 10 cm long, with leaves to 5.5 mm broad, prostrate or ascending to erect; lateral branches distant, diverging at a wide angle; flagelliform branches frequent, long. Line of leaf insertion curved in its upper half. Leaves imbricate, slightly to strongly falcate, deflexed, often becoming connivent when dry, asymmetrically ovate, often elongate, 1.5–2.5 mm long, to 1.5 mm broad at the base, narrowing to the obliquely truncate, tridentate apex; teeth mostly large, unequal, the acroscopic tooth longer than the others, four to eight cells long, three to five cells wide at the base, the margins straight to repand; leaf-cells thin-walled, the cell cavities stellate, the trigones very large, with strongly convex sides, soon becoming coalesced, the cuticle verruculose; cells of the apical portion 24–34 × 24 μ. Underleaves distant to imbricate, round-quadrate to elongate, 0.45–1.2 mm long, 0.45–0.8 mm broad, the apex rounded, entire, to faintly 2–4-lobed. Female branches occasional, the bracts and bracteoles of the innermost series to 1.25 mm long, ovate, divided to one-seventh of their length into three short, crenate segments, the cells to 48 μ long, 18 μ wide, thick-walled, the lateral margins crenate to short spinose. Perianth long, the mouth short-spinose, the cells thick-walled. Male branches and sporophyte not seen. Fig. 25, a–h.

Habitat: On rocks, logs and over tree bases.

CUBA: s.l., *Wright, Hep. Cubensis Wrightianae,* as *M. brasiliense* (FH); La Guinea, *Wright,* ex Hb. Gottsche 8 (G).

JAMAICA: Cinchona, *Johnson 39* p.p., (F); John Crow Peak, *Underwood 680* (NY); Sir John's Peak, *Johnson 47* (F); summit of Sugar Loaf, *M. Farr 1095* (IJ); Tweedside, *Underwood 2042* (YU); s.l., *Orcutt 2821, 5352* (BM).

PUERTO RICO: El Torro, *Steere 6460* (Hb. Fulford); El Yunque, *Steere 4287, 4402, 4404, 4409 4411, 4412, 4442, 5942* (Hb. Fulford); Luquillo Mountains, *Steere 4312, 4314, 4409* (Hb. Fulford); Sierra de Naguabo, *Shafer 3750* (NY); *Johnson 1620* (NY); Rio Sabana Trail, *Steere 6460* (Hb. Fulford).

ST. KITTS: s.l., *Breutel,* type of *M. gottscheanum* (B); s.l., *Breutel* (NY).

GUADELOUPE: Morne l'Echelle, *Duss 394* (NY); Soufrière, *Duss 83* (NY); *l'Herminier* (as *M. subfalcatum* f. *minor*) (G); s.l., *l'Herminier* (NY); s.l., *l'Herminier,* type of *M. tenue* (FH); s.l., *l'Herminier,* type of *M. subfalcatum* (G); s.l., *l'Herminier, 77, 84* (as *M. subfalcatum*) (G); s.l., *l'Herminier 68, 141* (as *M. speciosum*) (G); s.l., *l'Herminier* s.n., *33–35, 64, 66* (as *M. speciosum* f. *minor*) (G); s.l., *Richard* (NY); s.l., *Germain* (as *B. longistipula*) (G).

DOMINICA: Morne Micotrin, *Elliott 92, 1091, 1098a, 1100a, 1106c* pp., *1155* pp. *1228b, 1230d* p.p. (BM); Roseau Valley, *Elliott, 13b* (BM); Morne Trois Pitons, *Elliott 2242, 2250, 2254c, 2257a* (BM); s.l., *Elliott 1080, 2242,* (G); s.l., *Elliott* (as *M. arcuatum*) (G); s.l. *Elliott* (as *M. cuervii*) (G); s.l., *Elliott 1155* (as *M. portoricense*) (G); s.l., *Elliott* (as *M. scutigerum*) (G); s.l., *Elliott 1083, 1088, 1093, 1629* (as *M. speciosum*) (G).

MARTINIQUE: s.l., *Sieber 35* (type NY, isotype FH); Mt. Pelée, *Husnot Pl. Antilles no. 213,* type of *M. speciosum* (G); *Duss 394, 395, 584, 606* (NY); without locality or collector (FH); s.l., *Bordaz 94* (G).

TRINIDAD: s.l., *Crüger,* the type of *M. trinitatis* (G), *Crüger* (NY); without locality or collector ex Hb. Jack (G); s.l., *Beyrick* (G).

25a. Bazzania longa var. **papillata** (Stephani) Fulford, *Bazzania* Cent. S. Am. 94. *f. 33, 11.* 1946.

Mastigobryum papillatum Stephani, Spec. Hep. 3: 526. 1909.

This variety, collected in Dominica by Elliott, differs from var. *longa* in that the cuticle of the leaves and underleaves is very conspicuously roughened by large, coarse, wart-like protuberances. The cuticle of the leaves and underleaves of var. *longa* varies from faintly to strongly verruculose. In no instance are the verruculae even half as large as those of the var. *papillata.* Fig. 25, i.

DOMINICA: s.l., *Elliott,* type of *M. papillatum* (FH).

26. Bazzania sublonga Fulford, Bull. Torrey Club **86**: 334. *f. 42–46.* 1959.

Plants of medium size to large, olive-green to brownish-green; stems 6 cm or more long, with leaves 3–4 mm broad, prostrate to ascending; lateral branches frequent, 1–2 mm apart, diverging at a wide angle; flagelliform branches fre-

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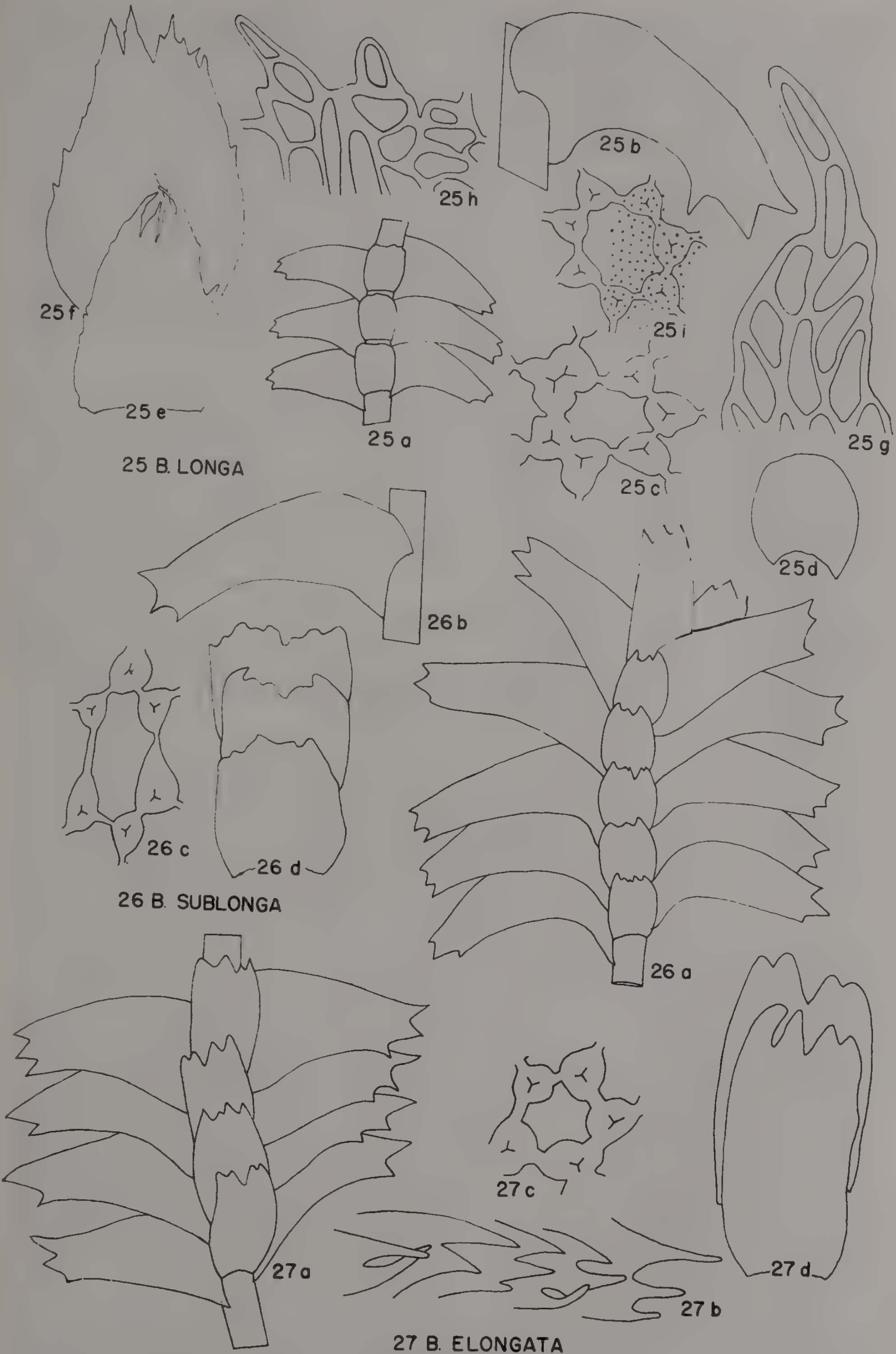
FIG. 25. *Bazzania longa.* 25 a. Stem, ventral view, × 12. 25 b. Leaf from another plant, × 30. 25 c. Leaf-cell, × 350. 25 d. Underleaf, × 30. 25 e, f. Female bracts of the innermost series, × 30. 25 g. Portion of a segment of one of these bracts, × 300. 25 h. Cells of the perianth-mouth, × 300.

FIG. 25i. *B. longa* var. *papillata.* Leaf-cell, × 400.

FIG. 26. *B. sublonga.* 26 a. Stem, ventral view, × 15. 26 b. Leaf, × 20. 26 c. Leaf-cell, × 400. 26 d. Underleaves, × 40.

FIG. 27. *B. elongata.* 27 a. Stem, ventral view, × 15. 27 b. Apices of leaves, × 40. 27 c. Leaf-cell, × 350. 27 d. Underleaves, × 40.


25 f
25 h
25 b
25 i
25 e
25 a
25 c
25 g
25 d
26 b
26 c
26 d
26 a
27 a
27 c
27 b
27 d

25 B. LONGA

26 B. SUBLONGA

27 B. ELONGATA

quent. Line of leaf insertion curved in the upper half. Leaves imbricate, falcate, becoming deflexed on drying, elongate, subrectangular to asymmetrically ovate, 1.5–2.0 mm long, 0.5–0.8 mm broad at the base, little narrowed to the tridentate apex; teeth equal to unequal, three to six cells broad at the base, three to six cells high, very sharp by one elongated cell. the sinuses rather broad, rounded; leaf-cells thin-walled with very large knot-like trigones with convex sides, the lumina elogate to angular-rounded, the cuticle faintly verruculose; cells of the apical portion 27–36 × 24–27 μ, those of the median and basal portions larger. Underleaves imbricate, quadrate to rectangular in outline, 0.48–0.55 mm long and wide, the lateral margins straight or undulate, entire. the apex truncate. the margin with shallow lobes and teeth and usually an incurved tooth at each end. Female branches occasional, the bracts (immature) crenate, laciniate. Male branches, perianths and sporophyte not seen. Fig. 26, a–d.

Habitat: In mats or tufts, on logs at higher altitudes.

JAMAICA: summit of Cuna Cuna Mountain, *M. Farr 1378* (type IJ), *M. Farr, 1389* p.p. (IJ); summit of John Crow Peak, *M. Farr 984* (IJ); sw of Ecclesdown, *M. Farr 1149* (IJ); Blue Mountain Peak, 6500–7325 ft, *Underwood* (NY).

This species appears to be restricted to the tops of peaks in Jamaica. The plants are large and combine characteristics of several species. They are similar to *B. latidens* in general appearance, but the leaf-cells of that species are smaller, only 20–24 μ, and the apical margins of the underleaves are rounded-entire or faintly undulate. The long falcate leaves suggest leaves of *B. longa,* but here again, the apices of the underleaves are rounded-entire or only undulate. The leaf-cells of the two species are quite similar. While the underleaves are similar to those of *B. glaziovii,* the leaf-cells of the latter are only 20–24 μ in diameter.

27. **Bazzania elongata** Fulford, Bull. Torrey Club **86**: 337. *f. 47–53.* 1959.

Plants large to robust, deep yellowish-brown to dark brown; stems stout, 6–10 cm or more long, with leaves to 4 mm broad; lateral branches distant, diverging at a wide angle; flagelliform branches frequent. Line of leaf insertion curved in the upper half. Leaves imbricate, more or less spreading-falcate, deflexed and often connivent when dry, asymmetrically ovate, elongate, 1.5–2.5 mm long, 0.6–0.8 mm broad at the base, narrowing conspicuously to the obliquely truncate, 3- or 2-toothed apex; teeth large, mostly long, the acroscopic tooth longest, two to seven cells broad at the base, three to ten cells long, narrow, acute, often with an uniseriate tip of two to six cells, the sinuses deep, narrow, acute, the margins straight or uneven; leaf-cells thin-walled, with very large, rounded trigones and secondary thickenings in the pits, the lumina angular-rounded to stellate, the cuticle coarsely verruculose; cells of the apical portion 36–45 × 27 μ. Underleaves imbricate, very long, rectangular in outline, at least twice as long as broad, 1.0–1.5 mm long × 0.5 mm broad, the lateral margins entire and parallel, the apex truncate, mostly deeply 4-lobed, sometimes one lobe longer and acuminate. Female branches frequent. the bracts and bracteoles ovate, divided to one-fourth their length or less into two or three short laciniae, with crenate to short-ciliate margins. Perianth to 5 mm long, the mouth contracted, crenate. Fig. 27, a–d.

Habitat: In mats or tufts, on trunks of living trees in *Bonnetia* forest.

VENEZUELA: Estado Bolívar, Chimantá Massif, 2000–2100 m, *Steyermark 75787* (type NY).

28. Bazzania crassidentata Fulford, Bull. Torrey Club **86**: 338. *f. 54–56.* 1959.

Plants very large, yellow-brown becoming dark brown; stems robust, 5–10 cm long, with leaves to 5 mm or more broad, prostrate or ascending; lateral branches 1 cm or more apart, diverging at a wide angle; flagelliform branches frequent; rhizoids scarce. Leaf insertion curved in the upper half. Leaves approximate to imbricate, spreading, with a tendency to become a little falcate, linear-lanceolate, to 2.5 mm long, to 1 mm broad at the base and tapering to a narrow, 0.3–0.5 mm, obliquely truncate, coarsely tridentate apex; teeth large, variable, mostly acute, five to ten cells long, three to five cells wide at the base, the basiscopic tooth always much smaller, the sinus deep, acute; leaf-cells thin-walled, but with very large knot-like, triradiate thickenings, the pits scarcely visible, the lumina stellate, often becoming rounded, the cuticle faintly verruculose; cells of the teeth averaging 26 × 29 μ, and of the lumina below the teeth 45 × 27 μ. Underleaves broader than the stem, subquadrate to oblong, the base cordate, the apical margin undulate to faintly lobed, occasionally with a tooth at the end. Leaves of the flagelliform branches large, scale-like, to 0.24 mm long. Male branches short, the bracts broadly ovate, concave. Female branches occasional, the bracts and bracteoles of the intermediate and innermost series long, broadly ovate, divided to one-third of their length into four crenate segments with cells averaging 0.65 μ long. Perianth long, the mouth of numerous cilia. Sporophyte not seen. Fig. 28, a–f.

Habitat: In mats and deep tufts, on trunks of trees and over tree bases and soil.

COLOMBIA: Dep. del Valle, Río Calima, *Cuatrecasas 21087b* (US).

VENEZUELA: Cumbre, along west rim, s from Camp Cano, *Cowan & Wurdack 31324* (type NY).

29. Bazzania jamaicensis (Lehmann & Lindenberg) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Herpetium jamaicense Lehmann & Lindenberg in Lehmann, Pug. Pl. 7: 7. 1838.
Mastigobryum jamaicense Lehmann & Lindenberg in G. L. & N. Syn. Hep. 223. 1845.
Mastigobryum chamaecardion Herzog ms. (nomen nudum.)
Mastigobryum caracanum Stephani, Spec. Hep. 3: 525. 1909.
Bazzania jamaicensis var. *chamaecardia* Herzog, Rev. Bryol. Lichénol. 11: 19. 1938.

Plants large, olive-green to brownish-green, strongly pigmented with brown; stems stout, to 10 cm or more long, with leaves to 4 mm broad, prostrate to suberect; lateral branches frequent, mostly more than 5 mm apart, diverging at a wide angle; flagelliform branches frequent, long, often branched. Leaf insertion curved in its upper half. Leaves imbricate, convex, strongly deflexed even when moist, asymmetrically ovate, a little falcate, to 2 mm long, 1–1.5 mm broad at the base, narrowing a little to the rather broad, transversely truncate, irregularly tridentate, apex; teeth acute, narrow to broad, some obscure, two to six cells long, two to nine cells broad at the base, the sinuses acute to lunulate; leaf-cells thin-walled, the lumina angular-rounded, the trigones small, conspicuous, soon becoming coalesced in the marginal and apical regions, the cuticle smooth to faintly verruculose; cells of the apical region averaging 20 × 20 μ. Underleaves approximate to imbricate, broader than the stem, appressed, broadly reniform from an auricled base, very concave when seen from above, 0.65 mm long, 0.8–1 mm broad at the base, the margin entire and often deep brown, the cells 22–32 μ long and broad, the lumina angular-rounded, the trigones small, conspicuous, the walls soon becoming thick by deposits of secondary thickenings and coalesced trigones. Male branches occasional, the bracts ovate, to 0.56 mm long, to 0.64 mm broad at the base, the apex entire, or with two or three short teeth, the bracteoles smaller; antheridia occurring singly. Female branches and sporophytes not seen. Fig. 29, a–e.

Habitat: In deep tufts or mats on trunks of trees.

JAMAICA: s.l., ex Hb. Hooker, (type NY, isotype G); Blue Mountain, *Evans 239* (YU); Blue Mountain Peak, 7300 ft, *Harris 20, 11060* (YU, NY); *Harris 11060* p.p. (BM); summit of Blue Mountain Peak, *Underwood 2505* (NY); Cinchona, *A. Barry 1454* (IJ); summit of High Peak, *M. Farr 910* (IJ); slopes of Sir John, *E. G. Britton 1209* (NY); e slope of Mossman's Peak, *M. Farr 744* (IJ).

COSTA RICA: Cerro de las Lajas, *Standley & Valerio 49949, 50713, 51446, 51645, 52117, 52267*, type of var. *chamaecardia* (US); Segovia, 4000 ft, *Oersted* (G); s.l., *Brade* (G).

HONDURAS: Uyuca, *Rodrigues 762* (F).

VENEZUELA: Valencia, *Fendler* (G); Caracas, *Funck & Schlim* (NY).

BRAZIL: Rio de Janeiro, *Gaudichaud* (NY), *Schiffner 815* p.p. (W); Caraça, *Wainio*, type of *M. caracanum* (FH), near Apiahy, *Schiffner 2328* (W); S. Catarina: Morro da Bateias, *Reitz 1.930, 1.931* (HBR); Caraça, *Wainio 35* (as *M. arcuatum*) (G); Paraná, *Dusén 3901* (G); S. Paulo, *Delessert* (as *B. glaziovii*) (G); s.l., *Jack*, ex Hb. Hampe (as *M. brasiliense*) (G).

ECUADOR: Cayambe, *Jameson* (NY).

PERU: Tatanera, *Lechler 3112* (NY).

30. Bazzania wrightii (Gottsche) Stephani, Hedwigia **27**: 279. 1888.

Mastigobryum wrightii Gottsche in Stephani, Hedwigia **25**: 237. *pl. 2. f. 24–26.* 1886.

Plants of medium size to large, light yellow-green, becoming yellow-brown; stems slender to robust, 5 cm or more long, with leaves to 4.5 mm broad, prostrate to ascending; lateral branches frequent, diverging at a wide angle; flagelliform branches numerous, long. Line of leaf insertion curved in its upper part. Leaves distant to imbricate, often becoming deflexed when dry, asymmetrically ovate, falcate, 1.5–3.0 mm long, 1.0–1.5 mm broad at the base, narrowed a little to the more or less obliquely truncate, irregularly tridentate apex; teeth mostly small, acute, to six cells long, three to five cells broad at the base, the sinuses shallow, lunulate, the margins entire; leaf-cells thin-walled, the cell lumina angular-rounded, the trigones conspicuous, with convex sides, soon becoming coalesced through the deposition of secondary thickenings, the cuticle faintly verruculose; cells of the apical portion mostly $24 \times 24\ \mu$. Underleaves distant to imbricate, subquadrate to orbicular, broader than the stem, 0.5–1.2 mm long, 0.5–0.95 mm broad at the base, the lateral margins convex from a rounded base, entire, the apical portion rounded, entire, straight, to four-lobed, a little squarrose, the cells $24–32\ \mu$, thin-walled, the trigones large, often coalesced, inter-

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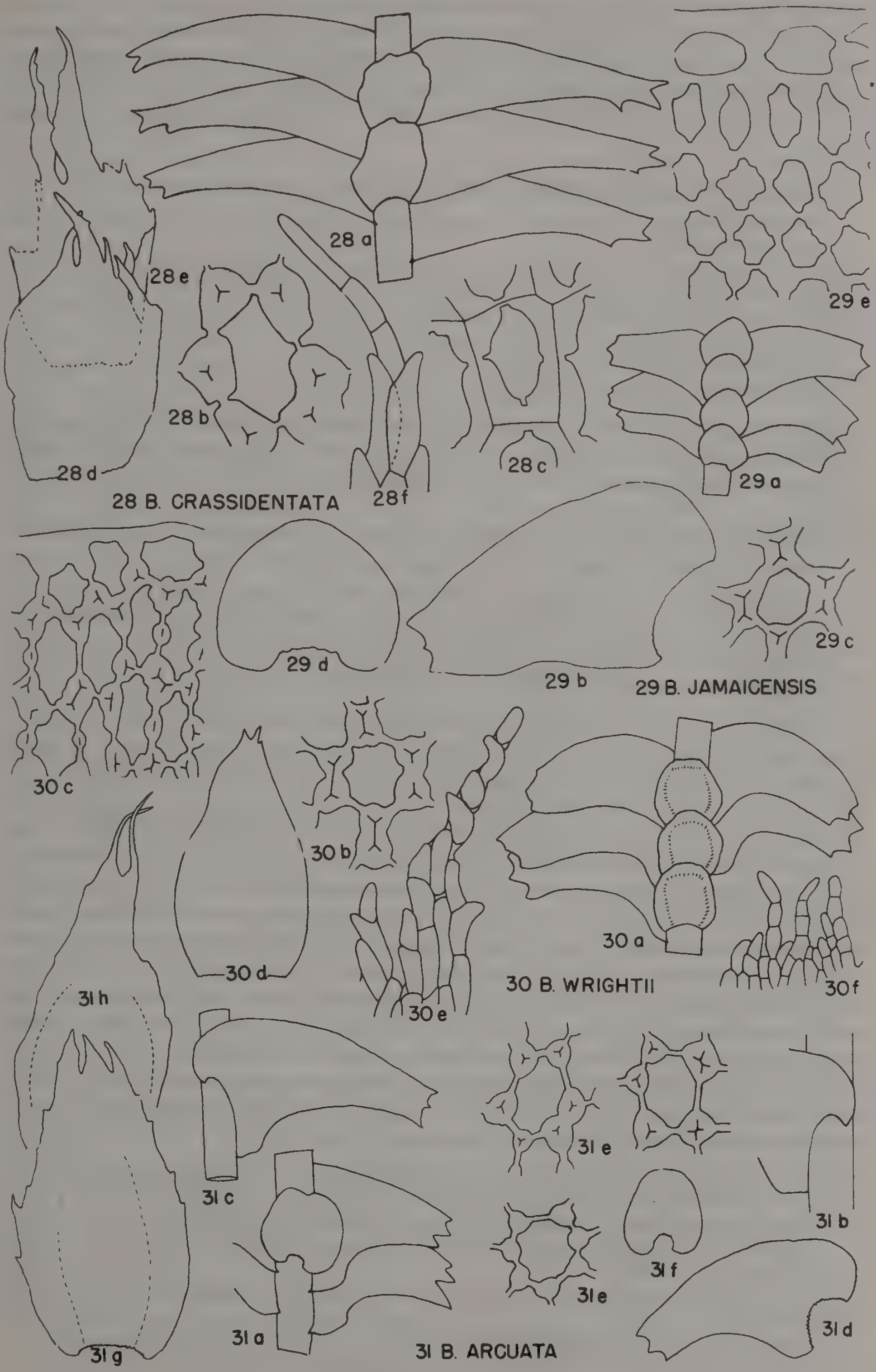
FIG. 28. *Bazzania crassidentata.* 28 a. Stem, ventral view, × 15. 28 b, c. Cells from the apical part of leaves, × 350. 28 d, e. Female bracts from the intermediate (d), and innermost (e), series, × 40. 28 f. Tooth from the perianth-mouth, × 350.

FIG. 29. *B. jamaicensis.* 29 a. Stem, ventral view, × 10. 29 b. Leaf, × 20. 29 c. Leaf-cell, × 350. 29 d. Underleaf, × 30. 29 e. Cells from the upper part of an underleaf, × 260.

FIG. 30. *B. wrightii.* 30 a. Stem, ventral view, × 15. 30 b. Leaf-cell, × 400. 30 c. Cells from the upper part of an underleaf, × 300. 30 d. Female bract of the intermediate series, × 30. 30 e. Lacinia of this bract, ×150. 30 f. Cells of the perianth-mouth, × 100.

FIG. 31. *B. arcuata.* 31 a. Stem, ventral view, × 15. 31 b. Leaf insertion, dorsal view, × 20. 31 c, d. Leaves. 31 e. Leaf-cells, × 350. 31 f. Underleaf. 31 g, h. Female bracts of the intermediate (g), and innermost series (h), series, × 40.


28 a
28 e
28 b
28 d
28 c
28 f
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29 a
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29 c
30 c
30 b
30 d
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30 e
30 f
31 h
31 c
31 e
31 e
31 b
31 f
31 a
31 d
31 g

28 B. CRASSIDENTATA

29 B. JAMAICENSIS

30 B. WRIGHTII

31 B. ARCUATA

mediate thickenings developed in the elongate cells of the apical portion. Female branches occasional, the bracts and bracteoles of the innermost series large, ovate, divided to one-sixth their length into two or three crenulate to spinose laciniae, the lateral margins crenulate to short-ciliate, the cells to 48 μ long, 24 μ wide, with thin walls. Perianth mouth laciniate-ciliate. Male branches not seen. Fig. 30, a–f.

Habitat: In mats on logs and bases of trees.

CUBA: Mt. Verde, *Wright*, Hep. Cubenses (type G, isotypes FH, YU); Loma del Gato, *Fr. Clément 351* (NY).

JAMAICA: Caledonia Peak, *M. Farr 1007* (IJ); Fairy Glade, *M. Farr 771, 788* (IJ); Hardwar Gap, *Baxter 11* (KANU); Hardwar Gap to waterfall, *M. Farr 866, 867* (IJ); Morce's Gap, *Evans 48* (YU); New Haven Gap, *M. Farr 928* (IJ); Tweedside, *Underwood 2042* (NY).

GUADELOUPE: Galion, *Le Gallo 266* (Hb Le Gallo).

DOMINICA: Castle Bruce River, *Eliott 11d* (BM).

The elongate cells with large trigones and knot-like intermediate thickenings are conspicuous just below the upper margin of the underleaves. This together with the size of the leaf-cells serve to distinguish the species from *B. jamaicensis.*

31. **Bazzania arcuata** (Lindenberg & Gottsche) Trevisan. Mem. Ist. Lomb. **13:** 414. 1877.

Mastigobryum arcuatum Lindenberg & Gottsche in G. L. & N. Syn. Hep. 718. 1847.
Mastigobryum martianum Gottsche in Stephani, Hedw. 25: 205. *pl. 16. f. 9–12.* 1886. Non *M. martianum* Lindberg.
Mastigobryum stoloniferum var. *cubense* Gottsche ms.
Mastigobryum ecuadorense Stephani, Spec. Hep. 6: 461. 1924.

Plants of medium size to large, olive-green, deeply pigmented with brown; stems to 5 cm or more in length, with leaves to 3 or 4 mm broad; lateral branches frequent, diverging at a wide angle. Line of leaf insertion hook-formed in the upper part. Leaves imbricate, spreading and strongly arcuate or falcate from a broad base with a distinct enlarged rectangular ventral auricle, asymmetrically ovate, 2–2.5 mm long, 0.8–1.4 mm broad at the base, narrowed to 0.32–0.48 mm at the tridentate apex; teeth acute, to 5 cells high, to 6 cells wide, the basiscopic tooth often much smaller, the sinuses mostly lunulate; leaf-cells thin-walled, the trigones conspicuous, with bulging sides, the lumina angular-rounded, cuticle slightly verruculose; cells of the apical region 20–26 × 20–22 μ. Underleaves subrectangular to orbicular, twice as broad as the stem, cordate at the base, 0.6–1.4 mm long, 0.7–1.0 mm broad at the base, the apical portion rounded-entire or more rarely straight, undulate, or with a short tooth. Male bracts broadly concave. Female inflorescence occasional, the innermost series of bracts and bracteoles divided to one-fourth or less into three or four segments. Perianth mouth laciniate-ciliate. Sporophyte not seen. Fig. 31, a–h.

Habitat: On moist cliff ledges, rocks and trees in elevated regions.

CUBA: Domo del Gato (as *M. stolonifera* var. *cubense*), *Wright* (G).

MEXICO: San Pedro Tepinapa, 2000–2500 ft, *Liebmann* (type G); Puebla: near Villa Juarez, *Sharp 3150* (TENN).

GUATEMALA: Alta Verapaz, *Standley 90324, 90635* (F); Huehuetenango, *Steyermark 49949, 49955* (F).

COSTA RICA: Mt. Hacum, *Tonduz* (G).

COLOMBIA: Río Apaporis, *Schultes & Cabrera 11959* (FH).

BRAZIL: s.l., *Martius*, type of *M. martianum* (G); Apiahy, *Puiggari 761a* (G); S. Paulo: Alto da Serra, *Schiffner 1610* (W); Rio Grande, *Schiffner 1095* (W); near Barra Mansa, Itapecira, *Schiffner 1582* (W); Santos: St. Vincente, *Horeau 10* (as f. *robustior*) (G); Santos, ***Mosén 99*** (as ***M. vincentinum***) (G).

ECUADOR: s.l., *Allioni* (Hb. Levier, 6406), type of *M. ecuadorense* (G); C. Bomboiza–Gualiquiza, *Allioni 525, 724* (G).

This species is distinct because of its arcuate leaves with a very broad base and a conspicuous enlarged rectangular ventral auricle, and its large, cordate underleaves, broadest at the base.

Section 2. Connatae

The plants of this section are of medium size to large, with three-toothed leaves (mostly entire in *B. schwaneckiana*), that may be serrulate to dentate in the apical part. They are inserted in an oblique line which is more or less curved in the upper part. The underleaves are attached in a straight line and are connate with the ventral bases of the leaves along one or both sides of the stem. (In many stems this attachment is evident only under high magnification.) Most of the species, but not *B. fendleri*, are highly variable and appear to grade into one another, so that there is often a series of forms to which it is difficult to assign names, and decisions become arbitrary. There are three groups of species: *B. fendleri* of tropical America, in which each underleaf is joined to one leaf by a broad base, always the same side of the stem; the group in the West Indies in which the underleaves are connate on one side with one row of leaves; and the group in southern South America, with certain species or related species also in New Zealand, Australia, etc., in which the underleaves are joined to both rows of leaves.

32. Bazzania fendleri (Stephani), Fulford, *Bazzania* Cent. S. Am. 105. *f. 47.* 1946.

Mastigobryum fendleri Stephani, Spec. Hep. 3: 436, 468. 1908.

Plants of medium size to large, whitish to light greenish-brown, more strongly pigmented in the older portions; stems to 5 cm long, with leaves to 3.5 mm broad, prostrate to ascending; lateral branches 5 mm or more apart, diverging at a wide angle; flagelliform branches numerous, long. Leaves imbricate, convex, ascendent, a little deflexed when dry, asymmetrically ovate, to 1.5 mm long, 0.7 mm broad at the base, narrowed a little to the more or less transversely truncate, obscurely tridentate apex; teeth one to three cells high, two or three cells broad at the base, the sinuses lunulate, the margins entire; leaf-cells thick-walled, the trigones large, with irregular, rounded sides, becoming confluent, intermediate thickenings sometimes present, the lumina angular-rounded, the cuticle verruculose; cells of the apical portion averaging 16 μ in diameter. Underleaves large, twice as broad as the stem, round-quadrate, connate with one leaf for a third their width, averaging 0.9 mm broad and long, the margins recurved, the apical margin entire to faintly four-lobed. Sexual branches not seen. Fig. 32, a–e.

Habitat: Not given.

VENEZUELA: Valencia, *Fendler* (type G, isotype FH).
BRAZIL: Rio de Janeiro, *Gaudichaud* (NY).
ECUADOR: Cayambe, *Jameson* (NY).

33. Bazzania schwaneckiana (Hampe & Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum schwaneckianum Hampe & Gottsche, Linnaea **25**: 345. 1852.

Plants scattered or growing in depressed mats, sometimes without leaves, mostly of medium size, light-green to olive-green, becoming brownish; stems to 5 cm long, with leaves mostly 1.5–2.5 mm wide, prostrate; lateral branches mostly 5 mm or more apart, diverging at a wide angle; flagelliform branches frequent, long, occasionally branched. Leaves approximate to imbricate, spreading, plane or nearly so, becoming deflexed on drying, asymmetrically long-ovate, mostly 1.2 mm long, 0.56 mm wide at the base, scarcely narrowed to the transversely truncate, rounded-entire to faintly two–three-toothed apex; leaf-cells of the marginal one or two rows often forming a border, uniformly thick-walled, mostly 16 × 10 μ, the cells of the apical region 20–24 μ, uniformly thin-walled, the trigones very small, the cuticle verruculose. Underleaves subimbricate, squarrose, with a hyaline border, connate by several cells with one leaf, quadrate to quadrate-orbicular, 0.34–0.38 mm long, 0.32–0.38 mm wide, the apex undulate to two- or four-toothed or -lobed, the hyaline border complete, two to four cells wide, broadest across the top, the cells similar to those of the chlorophyllose area but with thinner walls. Sexual branches and sporophyte not seen. Fig. 33, a–d.

Habitat: In wooded areas in depressed mats over logs and on shaded banks.

PUERTO RICO: s.l., *Schwanecke, Gottsche & Rabenhorst, Hep. Eur. no. 608* (isotypes NY, YU); near Adjuntas, *E. G. Britton & Marble 2175* (NY); Canovanas, *Pagán 274* (F); El Yunque, *Evans 166, 185* (Y, NY), *Steere 4649, 4676, 4681, 4819, 6078* (Hb. Fulford); Luquillo Mountains, *Heller 4646, 4653, 4760* (MO); *Sintenis 12* (G); Mt. Britton, *Steere 4224*, (Hb. Fulford); N. Guava purchase unit, *Steere 4819, 4831*, (HB. Fulford); Orocovis, *Pagán 22, 23* (F); Río de Maricao, *E. G. Britton 2503* (NY); La Torrecilla, *Steere 4651* (Hb. Fulford); s.l., *Schwanecke 19* (G).

GUADELOUPE: Pointe Noire, *Duss 43, 57* (NY); s.l., *l'Herminier* (FH, NY, YU); s.l., *l'Herminier 10, 11, 12, 32, 55* (G); without locality or collector ex Hb. Barbey–Boissier (as *M. venezuelanum* var. *β*, *Molenb.*) (G).

DOMINICA: Four Hand, *Fishlock 12a* (NY); Mt. Diablotin, *Elliott 2123, 2174* (BM).

MARTINIQUE: Calabasse; Morne Paillasse, *Duss 38, 369* (NY); s.l., *Duss 38* (G).

34. Bazzania pycnophylla (T. Taylor) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum pycnophyllum T. Taylor, London Jour. Bot. **5**: 375. 1846.

Plants light green to olive-green, becoming tinged with brown; stems slender, with leaves to 3 mm broad, prostrate; lateral branches 0.5 cm or more apart,

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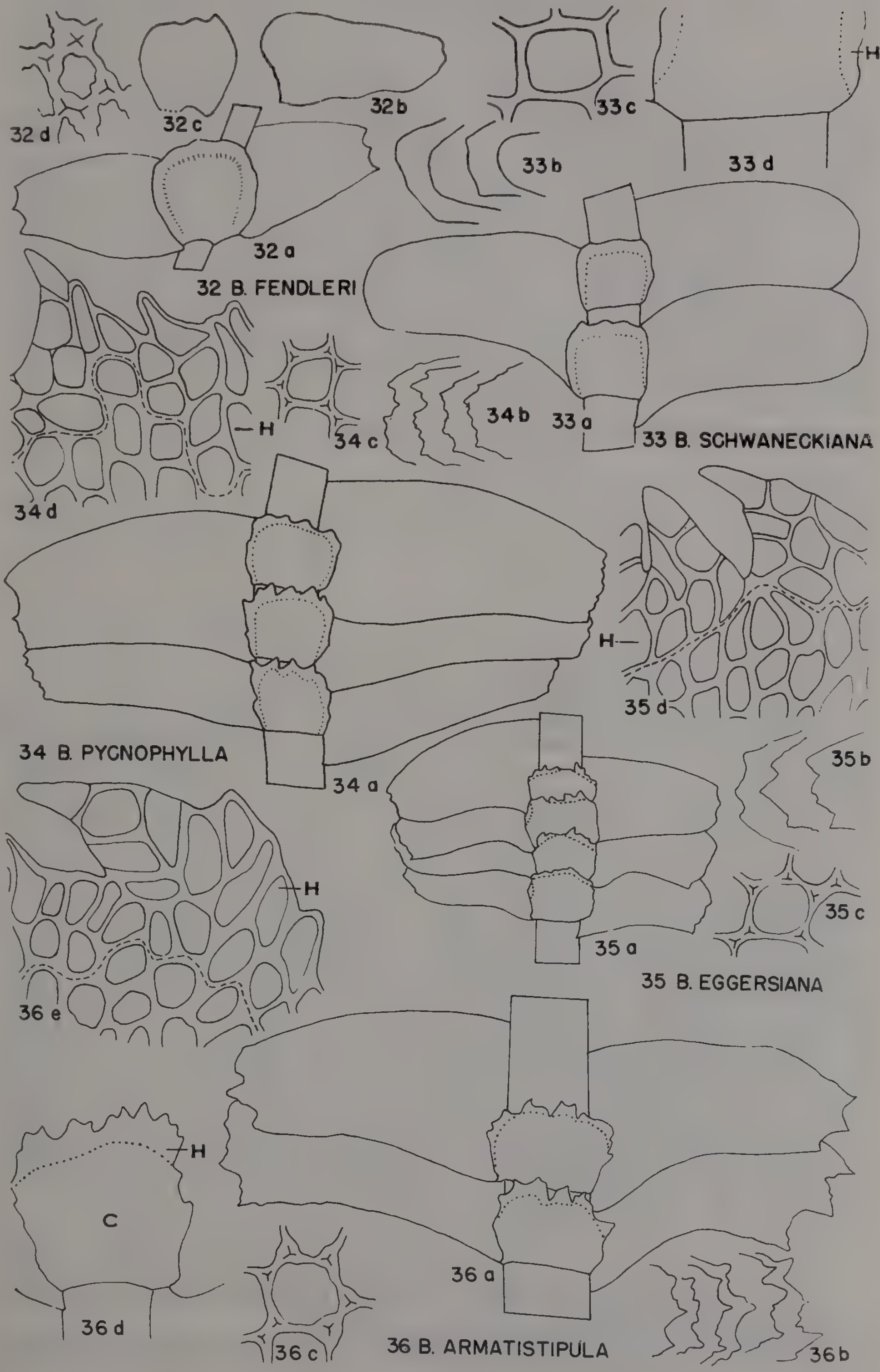
Fig. 32. *Bazzania fendleri.* 32 a. Stem, ventral view, × 15. 32 b. Leaf. 32 c. Underleaf. 32 d. Leaf-cell, × 400.

Fig. 33. *B. schwaneckiana.* 33 a. Stem, ventral view, × 30. 33 b. Apices of leaves, × 30. 33 c. Leaf-cell, × 400. 33 d. Attachment of an underleaf to the stem and a leaf, × 45; H, hyaline margin of the underleaf.

Fig. 34. *B. pycnophylla.* 34 a. Stem, ventral view, × 30. 34 b. Apices of leaves. 34 c. Leaf-cell, × 350. 34 d. Cells from the upper part of an underleaf, × 260; H, hyaline border.

Fig. 35. *B. eggersiana.* 35 a. Stem, ventral view, × 15. 35 b. Apices of leaves. 35 c. Leaf-cell, × 350. 35 d. Cells from the upper part of an underleaf, × 260; H, hyaline border.

Fig. 36. *B. armatistipula.* 36 a. Stem, ventral view, × 30. 36 b. Apices of leaves. 36 c. Leaf-cell, × 350. 36 d. Underleaf on the stem, × 30; C, chlorophyllose area, H, hyaline border. 36 e. Cells of the margin of an underleaf, × 260; H, hyaline border.



32 B. FENDLERI

33 B. SCHWANECKIANA

34 B. PYCNOPHYLLA

35 B. EGGERSIANA

36 B. ARMATISTIPULA

32 d
32 c
32 b
32 a
33 c
H
33 d
33 b
33 a
34 d
H
34 c
34 b
34 a
H
35 d
35 b
35 c
35 a
36 e
H
H
C
36 d
36 c
36 a
36 b

diverging at a wide angle; flagelliform branches frequent. Leaves imbricate, spreading, becoming somewhat deflexed on drying, asymmetrically long-ovate, to 1.4 mm long, 0.55 mm broad at the base, narrowing a little to the transversely truncate, serrulate to spinose, obscurely tridentate apex; teeth very short, acute, broad, the sinuses lunulate, the margins serrulate to spinose; leaf-cells subquadrate to rectangular in outline, the lumina rounded, the walls of the cells of the apical portion and the margins uniformly thickened, those of the interior thin with small but distinct trigones, the cuticle verruculose; cells of the apical portion 18 × 18 μ. Underleaves imbricate, connate by several cells with one leaf, in part hyaline, quadrate, mostly 0.48 × 0.48 mm, the lateral margins entire, serrate, or dentate, the apex 3–6-toothed, the teeth two to five cells broad at the base, two to four cells high, mostly serrate to dentate, the cells of the marginal rows (mostly of the teeth) hyaline, verruculose, with uniformly thin walls, those of the interior chlorophyllose, with thicker walls and small trigones. Sexual branches and sporophyte not seen. Fig. 34, a–d.

Habitat: In depressed mats on logs and bases of trees in woods.

JAMAICA: s.l., *Swartz* (type NY, isotype FH).

PUERTO RICO: Luquillo Mountains *Heller 4654* (MO), *Steere 4984* (Hb. Fulford), Maricao, *Pagán 247* (Hb. Pagán), *Steere 5625* (Hb. Fulford); Mt. Torrecillas, *Bro. Hioram 12* (NY).

GUADELOUPE: s.l., *l'Herminier* (FH).

35. **Bazzania eggersiana** (Stephani) Pagán, Bryologist **42**: 39. 1939.

Mastigobryum eggersianum Stephani, Spec. Hep. 3: 468. 1908.

Plants of medium size, light green to olive-green, becoming a little pigmented with brown; stems slender, to 5 cm long, with leaves to 3 cm broad, prostrate; lateral branches mostly 5 mm apart, diverging at a wide angle; flagelliform branches numerous, long. Leaves imbricate, spreading, plane or nearly so, sometimes a little deflexed on drying, asymmetric, long-ovate, mostly 1.4 mm long, 0.65 mm wide at the base, narrowing a little to the transversely truncate, tridentate apex; teeth mostly one to three cells long and two to four cells broad, the sinuses lunulate, the margins entire to serrulate; leaf-cells quadrate to rectangular in outline, thin-walled, the trigones small but distinct, the lumina rounded, the cuticle verruculose; cells of the apical region averaging 25 × 25 μ. Underleaves imbricate, squarrose in the upper part, connate by a few cells with one leaf, subquadrate, in part hyaline, 0.48–0.56 mm long, 0.56–0.64 mm broad, the apex with three to six, serrate to spinose-dentate teeth or lobes, the teeth to four cells broad, two to four cells high, the lateral margins serrate or with one or more teeth, the cells of the marginal one to four rows (mostly of the teeth) hyaline, strongly verruculose, with uniformly thickened walls without trigones, the cells of the interior chlorophyllose, with conspicuous trigones and unequally thickened walls. Sexual branches and sporophytes not seen. Fig. 35, a–d.

Habitat: In depressed mats on logs and bases of trees in woods.

CUBA: Banao Mountain, *Bro. Léon & Per. Roca 8075, 8340* (NY); Pinal de Santa Ana, 2400 ft, *Eggers* (type G, isotype FH); Monte de la Prenda, 2400 ft, *Eggers 519c* (NY).

JAMAICA: sw of Ecclesdown, *M. Farr 1151, 1199* (IJ).

PUERTO RICO: N. Guava purchase unit, *Steere 4967* (Hb .Fulford); Maricao, *Steere 5517, 5583 5757, 5764, 5838* (Hb. Fulford).

36. **Bazzania armatistipula** (Stephani) Fulford, *Bezzania* Cent. S. Am. 490. *f. 46.* 1946.

Mastigobryum armatistipulum Stephani, Spec. Hep. **3**: 490. 1908.

Plants of medium size, light green to olive-green, becoming pigmented with brown; stems slender, to 5 cm long, with leaves to 3 mm broad, prostrate; lateral branches 5 mm or more apart, diverging at a wide angle; flagelliform branches frequent, long. Leaves approximate to imbricate, spreading, plane or nearly so, asymmetrically ovate, mostly 1.4 mm long, 0.65 mm wide at the base, narrowing a little to the transversely truncate, serrate, tridentate apex; teeth two to five cells long, one to five cells broad at the base, the sinuses lunulate, the margins coarsely serrate; leaf-cells with thickened walls and small trigones, the lumina rounded, the cuticle verruculose; the cells of the apical region averaging 25 × 25 μ. Underleaves approximate to imbricate, connate by a few cells with one leaf, scarcely broader than the stem, subquadrate, mostly 0.56 mm long, 0.56–0.64 mm broad, with a hyaline border of one to five cells across the top, the lateral margins dentate to serrate, the apical margins incised, with three to six spinose-dentate teeth or lobes, the cells of the hyaline border averaging 18 × 12 μ, the chlorophyllose cells averaging 20 μ, with conspicuous trigones. Sexual branches and sporophyte not seen. Fig. 36, a–e.

Habitat: In depressed mats over logs and on tree bases in mountain woods.

CUBA: Sierra Maestra, *Bro. Léon, Clément & M. Roca 10471* (NY); Oriente, Sierra Maestra, *Morton 9460a, 9461* (US).

JAMAICA: s.l., *Börgensen* (type G, isotypes FH, YU); Blue Mountain, *E. G. Britton 1193* (NY); Caledonia Peak, *M. Farr 1008* p.p. (IJ); Chapelton to Bull Head, *Underwood 3400* (NY); Cuna Cuna Mountain, *M. Farr 1335, 1337, 1340, 1341, 1343* p.p. (IJ); s.l., *Wilson 186* (NY); near Hardwar Gap, 4000 ft, *Underwood 2242* (NY, YU); trail to Hardwar Gap, *M. Farr 865, 1250* (IJ); summit of Mt. Horeb, *M. Farr 951* (IJ); John Crow Peak, 5500–5800 ft, *Underwood 855* (NY), s.l., *Wilson 186* (NY).

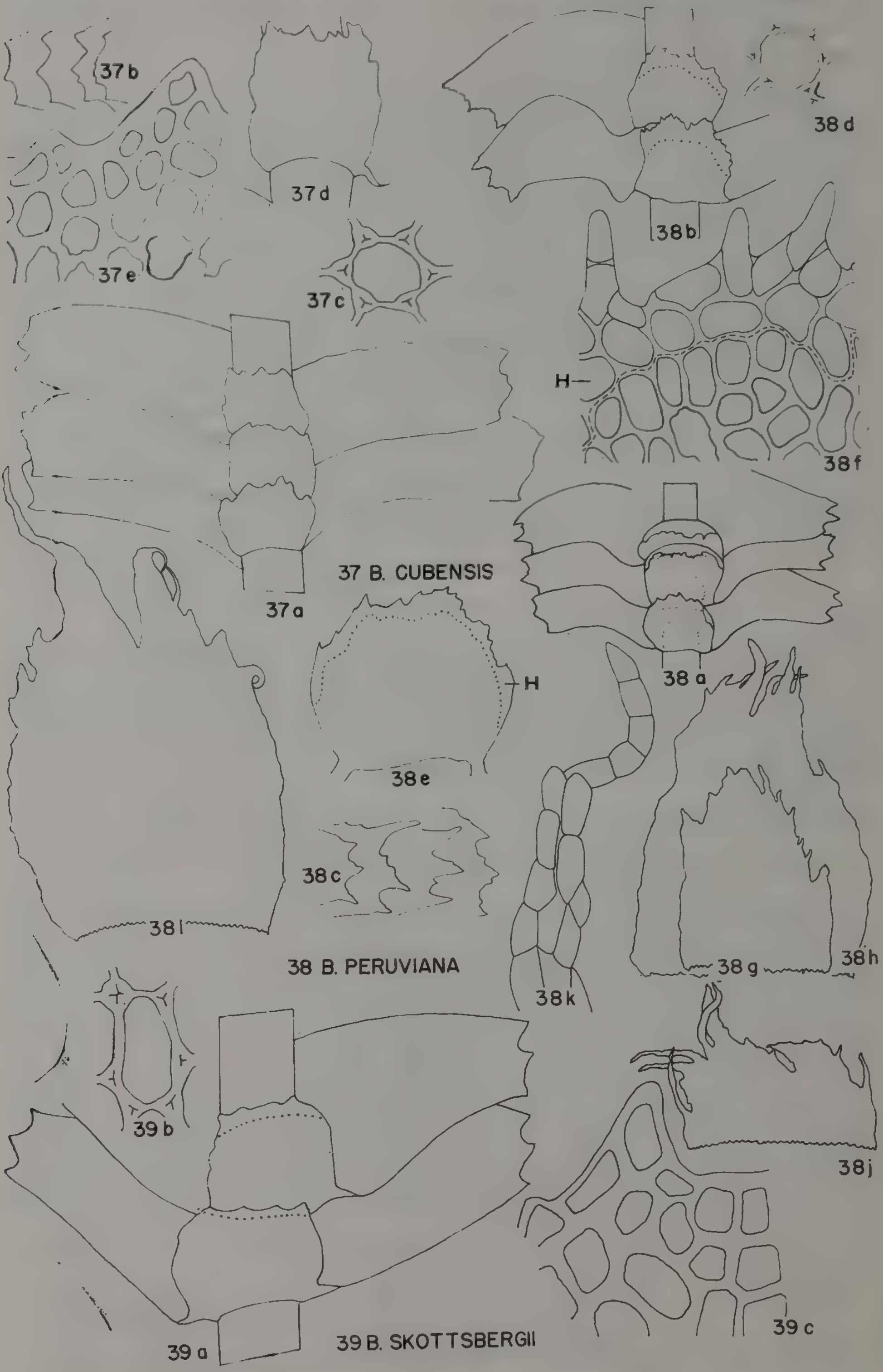
37. **Bazzania cubensis** (Gottsche) Pagán, Bryologist **42**: 38. 1939.

Mastigobryum cubense Gottsche in Stephani, Hedwigia **24**: 248. *pl. 3. f. 1.* 1885.

Plants of medium size, olive-green tinged with brown; stems slender, to 6 cm long, with leaves to 3.5 mm broad, prostrate; lateral branches mostly 1 cm or more apart, diverging at a wide angle; flagelliform branches frequent, long. Leaves imbricate, spreading, deflexed when dry, asymmetrically ovate, 0.9–1.6 mm long, 0.6–0.7 mm broad at the base, narrowed a little to the mostly transversely truncate, tridentate apex; teeth acute, large to obscure, two to eight cells long and three to six cells broad at the base, the sinuses lunulate, the margins mostly slightly serrulate; leaf-cells thin-walled, becoming thickened, the lumina angular-rounded, the trigones small, conspicuous, the cuticle very strongly verruculose; cells of the apical portion 22–25 × 25–30 μ. Underleaves quadrate, subimbricate, narrowly connate with one leaf, squarrose in the upper part, the lateral margins lobed and serrate, the apex incised, the teeth irregular, two to five cells broad at the base, two to four cells high, with entire to serrate margins. Sexual branches and sporophytes not seen. Fig. 37, a–e.

Habitat: In depressed mats on logs and bases of trees in mountain woods.

CUBA: Mt. Verde, *Wright, Hep. Cubenses Wrightianae* (type G, isotype NY, YU); Oriente: Moa Region, *Webster 812, 816* (MICH); Sierra Maestra, *Morton 9459* (US), *Bro.*


37 b
37 d
38 d
38 b
37 e
37 c
H
38 f
37 a
38 a
H
38 e
38 c
38 l
38 k
38 g
38 h
39 b
38 j
39 c
39 a

37 B. CUBENSIS

38 B. PERUVIANA

39 B. SKOTTSBERGII

Clément 343 (NY); Sierra Nipe, near Woodfred, 450–550 m, *Shafer 3344, 3434* (NY).

JAMAICA: summit of Bull Head, *Underwood 3390* (NY).

PUERTO RICO: Maricao, *Pagán 216a, 237, 251* (Hb. Fulford).

38. Bazzania peruviana (C. G. Nees) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum peruvianum C. G. Nees in G. L. & N. Syn. Hep. 220. 1845.
Mastigobryum lechleri Stephani, Hedwigia 25: 134. *pl. 6.* 1886.
Mastigobryum peruvianum var. *β minimum* Gottsche & Schiffner in Schiffner, Lebermoose. Forschungsreise S.M.S. "Gazelle" 4: 17. *pl. 4. f. 17, 18.* 1888.
Mastigobryum cerinum Stephani, Spec. Hep. 3: 457. 1908.

Plants of medium size to large (rarely small, pale and delicate), in dark green to brownish tufts or mats; stems 5 cm or more in length, with leaves to 3.5 mm broad; lateral branches mostly 5 mm apart diverging at an acute angle; flagelliform branches frequent. Leaves imbricate, plane, long, ascendent and becoming decurved to falcate from a broad base on long robust stems, less strongly falcate to ovate, spreading on smaller stems, 1.5-2.0 mm long, 1 mm broad at the base, narrowed to the transversely truncate, sharply tridentate apex; teeth variable, mostly slender, sharply acute, three to eight cells long, two to four cells broad, the sinuses mostly deeply lunulate, the margins serrulate to dentate; leaf-cells thin-walled, the trigones tiny to small, the lumina rounded, the cuticle verruculose; cells of the apical region averaging 20-24 μ. Underleaves large, imbricate, with a hyaline border above, often longer than broad, conspicuously connate with a pair of leaves, often becoming recurved in the upper half, the apex more or less incised and lobed and serrulate to spinose-dentate, the hyaline border four to eight cells broad (sometimes to half the leaf), the cells thin-walled, the chlorophyllose cells with thicker walls and small trigones. Female inflorescences occasional, the bracts and bracteoles broadly ovate, the bracts of the innermost series divided to one-third of their length into two or three laciniae, the margins coarsely incised and toothed. Perianth long, the mouth long-ciliate to laciniate. Male branches and sporophytes not seen. Fig. 38, a-k.

Habitat: Over soil, rocks and the bases and trunks of trees, in depressed mats or deep ascending tufts.

BRAZIL: S. Catarina, *Reitz 2.354*, poor (HBR).

PERU: without locality or collector, Hb. Gottsche (type FH); s.l., *Jameson* (NY).

CHILE: Valdivia, *Hahn 2* [2a] (G); the same, ex. Hb. Jack (FH, G); Valdivia, *Lechler*, type of *M. lechleri* (FH, G); Valdivia: Arique, *Lechler, Plantae chil. 681a* (G); the same, *681a* (as *M. novae-hollandiae*) (G); Port Montt, *Bro. Claude-Joseph 3216* (YU); Corral, *Thaxter 142, 149, 7913* (YU, FH), *20, 98* (MICH); Curico, *Wollemeyer 279a* (FH); s.l., *H. C. Lorenz* (NY); s.l., *Cuming* (G); s.l., *Dusén 355* (as *M. cerinum*) (G); s.l.,

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FIG. 37. *Bazzania cubensis.* 37 a. Stem, ventral view, × 20. 37 b. Apices of leaves. 37 c. Leaf-cell, × 350. 37 d. Underleaf on the stem, × 30. 37 e. Cells of the upper part of an underleaf, × 260.

FIG. 38. *B. peruviana.* 38 a. Stem, ventral view, × 15. 38 b. Another stem, ventral view, × 20. 38 c. Apices of leaves, × 30. 38 d. Leaf-cell, × 350. 38 e. Underleaf, × 30; H, hyaline border. 38 f. Cells of the upper part of an underleaf, × 310; H, hyaline border. 38 g, h. Female bracts of the outer (g) and intermediate (h) series, × 40. 38 i. Female bract of the innermost series, × 40. 38 j. Portion of the perianth-mouth. 38 k. One of the cilia of the perianth-mouth, × 90.

FIG. 39. *B. skottsbergii.* 39 a. Stem, ventral view, × 15. 39 b. Leaf-cell, × 350. 39 c. Cells of the upper part of an underleaf, where no hyaline cells were present, × 360.

Skottsberg 514/'08 (as *M. cerinum*) (G); Chile, *Schwabe 53* (Hb. Herzog); Chiloe Island, *Anderson* (NY), *Cunningham 1445* (NY); Isl. San Pedro, *Dusén 535*, and s.n. (G); Chiloe Isl.; Panguipulli, *Padre Hollermayer 279* (YU, Herzog Hb.); same locality, *Bro. Claude-Joseph 2322, 2322a* (YU); Chiloe Isl., ex Hb. Geheeb, as *M. involutum* (G).

STRAITS OF MAGELLAN: Chonos Archipelago, Darwin Bay, without collector, *442* (NY); Gray Harbor, *Cunningham 147* (NY); Port Otway, *Cunningham 255* (NY); Columbine Bay, West Channel, South Channel, ex Hb. Rome (as *M. cerinum*) (NY, G); s.l., *Schubert*, Hb. Mönkemeyer 8 (G); Tuesday Bay, *Naumann*, type of var. *β minimum* (FH); the same, *Naumann 68, 133* p.p. (FH); Desolación Isla., *Dusén 143* (2 packets, one as *M. cerinum*) (G).

PATAGONIA: Haire Molyneux, *Husnot 3* (G); Patagonia occ., Isl. Newton, *Dusén 76*, type of *M. cerinum* (G); s.l., *Hatcher* (YU); Patagonia austral., *Skottsberg 621* p.p./'08 (G).

JUAN FERNANDEZ ISLANDS: several localities, *Skottsberg* (Swed. Exped. Patagonia, und Feuerl., 1907–1909), including *191*, with hyaline underleaves (as *M. skottsbergii*) (G); several localities, *Skottsberg* (Swed. Pacific Exped. 1916–1917), *Bazzania nos. 7, 10*, (S-PA).

This species and the next, *B. skottsbergii*, form a highly variable complex, the plants of which vary in habit, color, size, leaf shape, cell size, thickness of cell wall, teeth, degree of serration on the margin, and in the position and the characteristics of the underleaves. The size and shape of the underleaves vary with the size of the stem; the upper part may be recurved or plane and the hyaline margin may extend to half the leaf or it may be limited to one or a few rows or even only scattered cells.

Some of the robust plants of the early collections were given names of New Zealand or Pacific species of this general habit, as *M. novae-zelandiae* (Mitten), *M. involutum* (Montagne), *M. adnexum* (Lehmann & Lindenberg), and *B. platycnemum* Schwaegrichen ex Stephani, and others.

The collections on which these reports were based have not been studied, but the type or authentic material of each of the species has been examined. These latter show as much variation as do the American species. It is obvious that the whole complex of these South-Temperate-Antarctic taxa of the section *Connatae* need to be studied as a group.

39. **Bazzania skottsbergii** (Stephani) Fulford, *Bazzania* Cent. S. Am. 122. 1946.

Mastigobryum skottsbergii Stephani, Sv. Vet.-Akad. Handl. **46**(9): 60. *f. 22, i, k.* 1911.
Mastigobryum crebrerrimum Stephani, Sv. Vet.-Akad. Handl. **46**(9): 60. *f. 22, c, d.* 1911.

Plants of small to medium size, light greenish-brown to dark brown; stems to 3 cm or rarely to 5 cm long, with leaves mostly 2 mm broad, prostrate to ascending; lateral branches frequent, 3–5 mm apart, diverging at an acute angle; flagelliform branches frequent. Leaves imbricate, spreading to ascendent, plane, with a straight ventral margin, weakly ovate, mostly 1.5 mm long, 0.8 mm broad at the base, narrowed a little to the transversely truncate, tridentate apex; teeth two to four cells long, slender to spinose or obscure, the margin often serrulate to dentate; cell-walls thin but soon becoming thickened, the trigones small, the lumina angular-rounded, the cuticle often strongly verruculose; cells of the apical region mostly 24–27 μ or more × 24 μ. Underleaves approximate or imbricate, broader than long and broader than the stem, connate with a pair of leaves, rarely recurved above, the upper margin rarely incised, more often with distant short spines or only serrate or even entire, with scattered hyaline cells, or one or two rows forming a hyaline border. Sexual branches and sporophyte not seen. Fig. 39, a–c.

Habitat: In tufts or mats on rocks and bases and trunks of trees.

CHILE: Corral, *Thaxter 68* (MICH); Valdivia, without collector (G); Chiloe Isl., San Pedro, *Skottsberg* (as *M. creberrimum*) (G).

STRAITS OF MAGELLAN: Smyth Channel, without collector, ex Hb. Bescherelle (as *M. involutum* f. *minor*) (G).

PATAGONIA: Pat. austral., *Skottsberg 621* p.p./'*08* (G); Pat. occid., *Skottsberg 876*, type of *M. creberrimum* (G).

JUAN FERNANDEZ ISLANDS: Masatierra, *Skottsberg 50*, lectotype, and *118* (Swed. Exped. Pat. Feuerland, 1907–1909) (G); Masatierra, Skottsberg *Bazzania nos. 1–4, 6, 7, p.p. 8, 9, 11–14* (S-PA).

Bazzania novae-zelandiae (Mitten) Bescherelle & Massalongo.

Although this New Zealand species has been reported from southern South America, no specimens that fit the description have been seen.

Section 3. Fissistipulae

The plants of this section have sharply three-toothed leaves in which a vitta or ventral appendages or auricles are not developed. The underleaves are divided to the middle into usually four long lobes or teeth. They are not connate with the leaves and are not auriculate at the base.

40. Bazzania chimantensis Fulford, Bryologist **63**: 88–91. *f. 1–7.* 1960 [1961].

Plants of small to medium size, in large depressed brown mats; stems yellow-brown, with greenish-brown growing tips; stems slender, 6–8 cm long, with leaves to 1.5 mm broad, often smaller; lateral branches occasional, forming an acute angle; flagelliform branches frequent, long, or occasionally leafy. Rhizoids not seen. Line of leaf insertion curved in the upper part. Leaves widely spreading, distant to approximate, usually plane, brittle, often broken but not truly caducous, variable in outline, rectangular or more rarely ovate, the margins uneven and conspicuously crenulate throughout, averaging 0.75–0.8 mm long, 0.45–0.5 mm wide at the base, little narrowed to the transversely or more rarely obliquely truncate tri-(bi-)dentate apex; teeth long, mostly equal, 2–4 cells broad at the base, to 12 cells long, with half the length a crenulate, uniseriate tip, the sinuses deep, usually narrow, acute; leaf-cells of the apical portion below the teeth 36–45 × 36 μ, with very large spherical trigones separated by narrow pits or coalesced to form a very thick cell wall, the cells of the rest of the leaf similar, scarcely larger, a vitta not differentiated, the lumina stellate, the cuticle faintly verruculose. Underleaves conspicuous, divided to the middle into four slender, lanceolate to linear teeth, distant to approximate, little broader than the stem, subquadrate-orbicular in outline, tending to be squarrose, averaging 0.36 mm long and broad, the margins convex or more rarely with a broad lobe, the teeth two or three cells broad at the base, ending in a uniseriate row of 2–4 crenulate cells, or 2-celled for most of the length; the cells as in the leaves. Male and female inflorescences and sporophyte not seen. Fig. 40, a–f.

Habitat: In large brown mats on a vertical sandstone boulder on a forested slope.

VENEZUELA: Estado Bolívar, Chimantá Massif: vicinity of Camp 3, northwestern part of Abácapa-tepuí, 1300 m, *Steyermark 75216* in 1953, (type F, isotype NY).

There are no other species of this section in Latin America, nor does the species appear to be closely related to any other American species.

Section 4. Appendiculatae

The plants of this section are for the most part large to robust. The leaves are attached in an oblique line which is hook-form above, and are sharply 3-toothed, obscurely 3-toothed, subentire or undivided. The ventral base of the leaf is always dilated to a greater or lesser degree, forming an entire, serrulate, dentate, incised, or appendiculate auricle. The underleaves are large and cordate to incised-appendiculate at the base from a recurved line of insertion.

41. Bazzania schlimiana (Gottsche) Fulford, Bull. Torrey Club **86**: 401. 1959.

Mastigobryum schlimianum Gottsche, Ann. Sci. Nat. V. Bot. 1: 140. 1864.
Mastigobryum asperistipulum Stephani, Spec. Hep. 6: 453. 1924.
Bazzania asperistipula Fulford, *Bazzania* Cent. S. Am. 125. *f. 44.* 1946.

Plants very large, light yellow-green, becoming light brown; stems stout, 10 cm or more long, with leaves to 6 mm broad, erect; lateral branches infrequent, 1 cm or more apart, diverging at a wide angle; flagelliform branches infrequent, long, the scale-leaves large, broader than the branch, to 0.35 mm long, ovate. Leaves always spreading, subimbricate to imbricate, asymmetrically long-ovate, a little falcate, to 4 mm long, 2 mm broad at the base, narrowing to the rather broad, transversely truncate, tridentate apex, the dorsal margin strongly curved from a deeply cordate base, the ventral base conspicuously auricled, the auricle oblong, undulate and lobed, crenulate, serrate; teeth broadly triangular, acute, five to ten cells long and five to ten cells broad at the base, the margins straight to repand; leaf-cells thin-walled, the lumina angular-rounded, the trigones small, conspicuous, often becoming confluent, the cuticle strongly verruculose; cells of the apical region averaging 22 × 22 μ. Underleaves imbricate, twice as broad as the stem, subquadrate in outline, somewhat squarrose, 0.8–1.4 mm long and wide, the base strongly cordate, the auricles large, undulate, their margins lobed, serrate and often short-ciliate, the apex and lateral margins lobed and toothed, the lobes broad and shallow, crenulate to serrate, often dentate or short-ciliate. Female branches occasional, the bracts of the intermediate and innermost series broadly ovate, divided to one-third or one-fourth of their length into usually three long, dentate to ciliate segments, the cells 72–90 × 20 μ, with thin walls. Perianth long, the mouth long-laciniate, the laciniae crenulate to ciliate, mostly twelve or more cells long. Male branches and sporophytes not seen. Fig. 41, a–g.

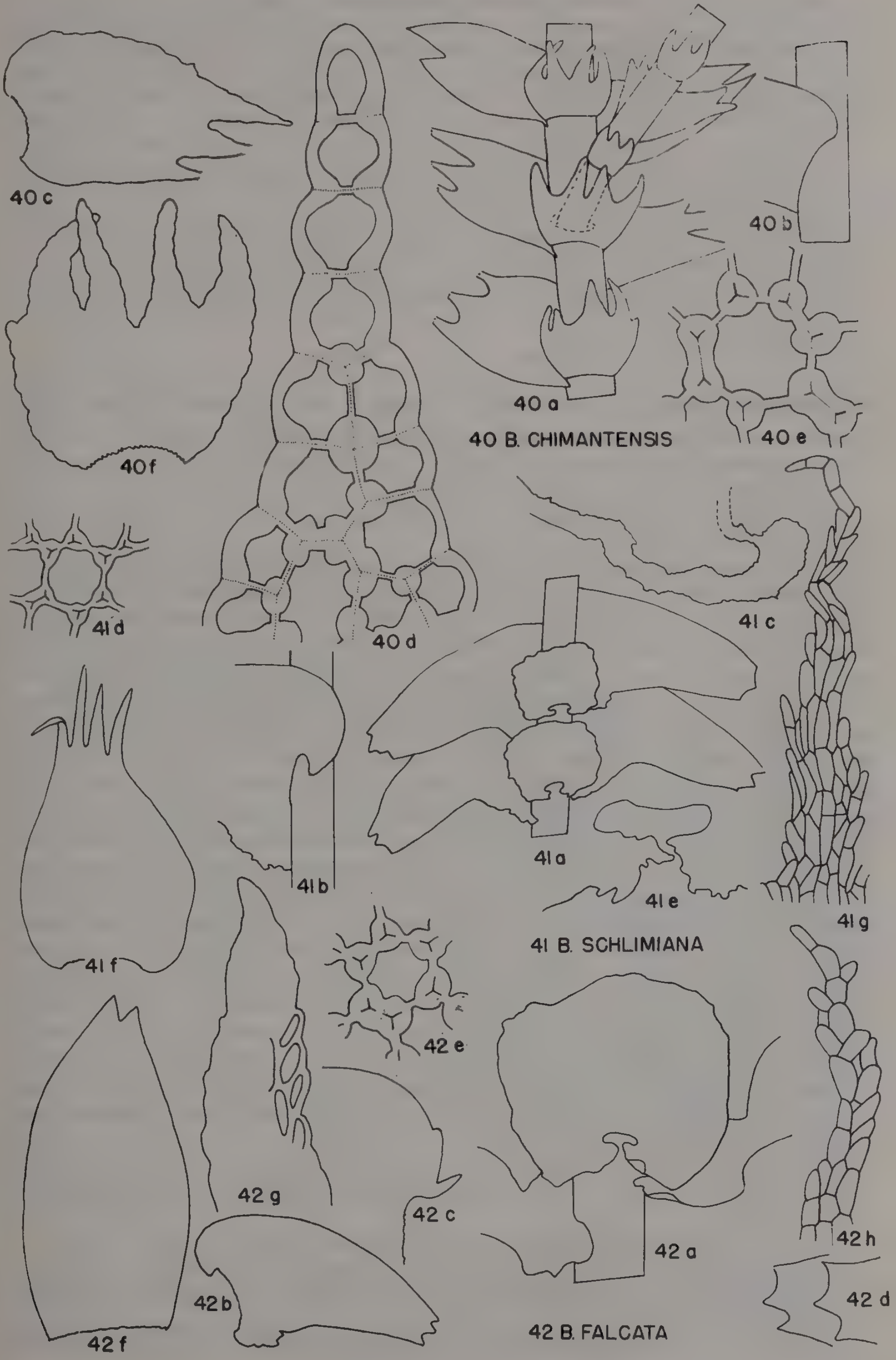
Habitat: In deep tufts on stumps, logs and tree trunks.

GUATEMALA: Alta Verapaz: Cobán, 1600 m, *Türckheim* (Hb. Levier 5817), type of *M. asperistipulum* (type G, isotypes NY); *Türckheim 5503* (as *M. teretiusculum*), *5582* (NY);

FIG. 40. *Bazzania chimantensis.* 40 a. Stem with a ventral branch, ventral view, × 80. 40 b. Leaf insertion on the stem. 40 c. Leaf, ×90. 40 d. Tooth of a leaf, × 350. 40 e. Leaf-cell, × 350. 40 f. Underleaf, × 180.

FIG. 41. *B. schlimiana.* 41 a. Stem, ventral view, × 10. 41 b. Leaf insertion on the stem. 41 c. Ventral auricles of two leaves, × 60. 41 d. Leaf-cell, × 350. 41 e. Base of an underleaf, × 60. 41 f. Female bract of the intermediate series, × 15. 41 g. One of the laciniae of the perianth-mouth, × 50.

FIG. 42. *B. falcata.* 42 a. Underleaf on a stem, × 30. 42 b. Leaf, × 15. 42 c. Dorsal base of a leaf with appendages, × 30. 42 d. Apices of leaves, × 30. 42 e. Leaf-cell, × 350. 42 f. Female bract of the intermediate series, × 30. 42 g. Tooth of this bract, × 100. 42 h. One of the laciniae of the perianth-mouth, × 100.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42 a
42 h
42 d
42 b
42 f

40 B. CHIMANTENSIS

41 B. SCHLIMIANA

42 B. FALCATA

s.l., *Seler 2659* (as *M. braunianum*) (G); El Progreso, *Sharp 2736a* (TENN).

COSTA RICA: Santa Clara, *Torres 219* (F); Alto de la Estrella, *Standley 39106, 39403* (US); Coliblanco, 1950 m, *Maxon* (NY); Vara Blanca, 1600–1700 m, *Maxon & Harvey 8266* (Hb. Herzog); Santa Clara de Cartago, 1950 m, *Maxon & Harvey 8188* (Hb. Herzog), Cerro de la Carpintera, *Standley 35632* (US); Orosi, *Standley 39650* (US); El Muñeco, *Standley 51338* (US); Prov. Heredia, 2000–2400 m, *Standley 52164a* (Hb. Herzog).

COLOMBIA: s.l., *Wallace* (NY); Merida, *Moritz 167* (G), *Funck & Schlim 167* (as *M. portoricense*) (G); Prov. Rió Hoche, Sierra Nevada, 10,000 ft, *Schlim 868* (type G). Dep. Norte de Santander, *Cuatrecasas, Schultes & Smith 12448GG, 12448K, 12448M, 12448W* (US); Dep. del Valle, Monte La Guarida, *Cuatrecasas 22196* (US).

VENEZUELA: Caracas, without collector (FH), without collector, ex Hb. Gottsche 1002, 1003, ex Hb. Jack (G); Merida, 2300 m, *Magdefrau 602* (Hb. Fulford).

BRAZIL: Rio de Janeiro, *Schiffner 623* (W); Apiahy, *Puiggari 296* (G).

ECUADOR: Quito, *Cuming* (as *M. humifusum*) (G); Paraná del Matauga, 3400 m, *Allioni 681* (as *M. arcuatum*) (G).

PERU: Callao, *Nöllner* (G).

42. **Bazzania falcata** (Lindenberg) Trevisan, Mem. Ist. Lomb. **13**: 415. 1877.

Mastigobryum falcatum Lindenberg in G. L. & N. Syn. Hep. 231. 1845.
Bazzania ancistrodes Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 380. 1885.
Mastigobryum tocutianum Gottsche in Stephani, Hedwigia **25**: 236. *pl. 2. f. 18–20.* 1886.
Mastigobryum ancistrodes Stephani, Spec. Hep. **3**: 501. 1908.
Mastigobryum armatum Stephani, Spec. Hep. **3**: 528. 1909.

Plants large, ochraceous yellow to dark brown, greenish in the younger portions; stems robust, to 10 cm long, with leaves to 6 mm broad, depressed to ascending; lateral branches frequent, diverging at a wide angle; flagelliform branches frequent, short, with 3 rows of large, scale-like, ovate leaves, 0.25–0.33 mm long. Leaves densely imbricate, convex, deflexed, connivent when dry, asymmetrically long-ovate, somewhat falcate, to 3.5 mm long, 2 mm broad at the base, narrowing to the mostly 0.65 mm broad, truncate, tridentate apex, the dorsal base deeply cordate, sometimes with a marginal appendage, the ventral auricle large, oblong to rounded, undulate, entire or toothed; teeth broadly triangular, acute, five to eight cells broad at the base, to six cells high, widely spreading, the margins straight to repand; leaf-cells with thickened walls, the lumina stellate, the trigones very large, with convex sides, mostly confluent with narrow pits; cells of the apical portion 18 μ in diameter, the cuticle faintly verruculose. Underleaves imbricate, subquadrate, 0.8–1 mm long from the line of attachment, the base cordate, the auricles large, undulate, rounded or toothed, the lateral margins sinuate, or short toothed, the apex undulate to 2–4-lobed or occasionally toothed. Female branches occasional, the bracts of the intermediate and innermost series similar, long-ovate, divided to one-fifth or one-sixth of their length into two or three crenulate teeth, six to ten cells long, four to six cells broad at the base, the cells 45–72 $\times$ 22 μ, with unequally thickened walls. Perianth long, the mouth laciniate, the laciniae six to twelve cells long. Male branches and sporophyte not seen. Fig. 42, a–h.

Habitat: In tufts or scattered among mosses on logs and rocks, rarely on trees, in forests.

CUBA: top of Gato Hill, 100 m, *Bro. Clément 1908* (YU, NY).

PUERTO RICO: Sierra de Naguabo, 465–700 m, *Shafer 3774, 3781* (NY).

GUADELOUPE: s.l., ex Hb. Hooker (type NY, isotype G); s.l., *l'Herminier 159*, ex Hb. Gottsche 1007 (G).

ST. VINCENT: without locality or collector, ex Hb. Hooker (NY); St. Andrews, *Eggers* (F).

TRINIDAD: El Tucuche, *Crüger*, type of *M. tocutianum* (G); El Tucuche, *Broadway 7100, 7100-1* (BM).

COSTA RICA: Los Angeles de San Ramón, *Brenes 17117* (F); Peralta, *Alfaro 40, 48a* (F).

COLOMBIA: Dep. del Valle, Puerto Merizalda *Cuatrecasas 14049* (US); Rió Calima, *Cuatrecasas 21179b* (US);

VENEZUELA: Cumbre, *Maguire, Cowan & Wurdack 30697* (NY);

BRAZIL: subtropics, *Ule*, type of *M. armatum* (FH); S. Catarina, *Carl 145* (ex Hb. Herzog); S. Paulo: Campo Grande, *Schiffner 464, 465* (W).

ECUADOR: Cayambe, *Jameson* (NY); Quito, *Jameson* (NY); Gualiquiza, *Allioni 526* (as *M. arcuatum*) (G); s.l., *Allioni* ex Hb. Levier 6578 p.p. (as *B. ecuadorensis*) (G); Azuay, *Steyermark 52687-4* (F).

PERU: Mt. Campana, *Spruce*, *Hep. Spruc.*, type of *M. ancistrodes* (isotypes FH, NY).

BOLIVIA: Mapiri, 5000 ft, *Rusby 3027* (as *B. arcuata*) (G).

Some of the plants from South America, particularly those from Ecuador and Peru, have underleaves with scattered long teeth on the margins and more conspicuously toothed ventral auricles on the leaves. The other characteristics of these plants, especially the cell size and the very large, knot-like trigones, agree with those of *M. falcatum*.

43. **Bazzania hookeri** (Lindenberg) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum hookeri Lindenberg in G. L. & N. Syn. Hep. 226. 1845.
Mastigobryum superbum Montagne, Ann. Sci. Natur. IV. Bot. **5**: 349. 1856.
Bazzania superba Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.
Bazzania vincentina var. *subrectifolia* Spruce ms. p.p., *Hep. Spruc.*
Bazzania flavicans Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 377. 1885.
Mastigobryum flavicans Stephani, Spec. Hep. **3**: 529. 1909.
Mastigobryum braunianum Stephani, Spec. Hep. **3**: 521. 1909.
Mastigobryum guadaloupense Stephani, Spec. Hep. **3**: 518. 1909.
Mastigobryum verrucosum Stephani, Spec. Hep. **3**: 524. 1909.
Mastigobryum douini Stephani in Herzog, Biblioth. Bot. **87**: 224. *f. 164, a–c.* 1916.

Plants of medium size to robust, olive-green to brown, deeply pigmented in the older portions; stems to 10 cm long, with leaves to 4.5 mm broad, prostrate to suberect; lateral branches infrequent, diverging at a wide angle; flagelliform branches frequent, long, the leaflets large, broader than the branch, spreading, broadly ovate. Leaves approximate to imbricate, mostly plane, asymmetrically ovate, becoming falcate, 2–2.5 mm long, 1–1.5 mm broad at the base, narrowed a little to the transversely truncate, tridentate apex, the dorsal margin strongly arched from a cordate base, the ventral auricle inconspicuous, entire; teeth broad, eight to ten cells long and broad, the sinus lunulate, the margins entire; leaf-cells thin-walled becoming thick-walled, with narrow pits, the lumina angular-rounded, the trigones large, with convex sides, often coalesced, the cuticle coarsely verruculose; cells of the apical portion 16–20 μ. Underleaves approximate to imbricate, round-quadrate in outline, to 1.2 mm long and broad, the base deeply cordate, the auricles large, not overlapping, entire, the lateral margins and apex entire, repand or irregularly and bluntly toothed or lobed. Sexual branches and sporophyte not seen. Fig. 43, a–h.

Habitat: In deep tufts, on soil and on bases and trunks of trees.

CUBA: Sierra Maestra, *Bro. Clément 351* (NY).

JAMAICA: Blue Mountain Peak, *Underwood 1485* (NY); John Crow Peak, *Philipson 1083* (BM); s.l., slope of Mossman's Peak, *M. Farr 730* (IJ).

SANTO DOMINGO: Quita Espuela, *Abbott 2137* p.p. (BM).

GUADELOUPE: s.l., *Parker 26* (type G, isotype NY); s.l., *l'Herminier* (NY); s.l., *l'Herminier 53c, 59, 140* (G); s.l., *Marie,* type of *M. guadeloupense* (FH); s.l., *l'Herminier 114* (as *M. portoricense*), *121* (G); s.l., *l'Herminier* ex Hb. Gottsche 1001 (G); Soufrière, *Duss 320* (as *M. portoricense*) (NY); forêt de Baines Jaunes, *Le Gallo 245, 260* p.p., *262* p.p. (Hb. Le Gallo); Galion, *Le Gallo 255* (Hb. Le Gallo).

DOMINICA: s.l., *Elliott 1041* p.p., *1167* (as *M. arcuatum*), *1932* (as *M. portoricense*) (G).

TRINIDAD: Mt. Tucuche, *Birch* (NY); Tucuche, *Broadway 7098, 7099* (BM).

GUATEMALA: Nebaj, 8500 ft, *Sharp 2516* (TENN); Pitoreal, *Sharp 2771a* (TENN); Alta Verapaz, *Standley 91868, 920631* (F); Huehuetenango, *Steyermark 48797, 49172* (F); Sierra de las Minas, *Steyermark 30002* (F).

COSTA RICA: Los Angeles de San Ramón, *Brenes 16264, 17121, 19018* (F); Sarchí, *Alfaro 7* (F).

COLOMBIA: Río Papuri, Teresita, *Schultes & Cabrera 19457* (FH); Río Hacha, Sierra Nevada, 10,000 ft, *Schlim 868* (as *M. stolonifera*) (G); Dep. Norte de Santander, Sarari, *Cuatrecasas, Schultes & Smith, 12448aa, B, J, U* (US).

VENEZUELA: Estado Bolívar, Tirepón-tepuí, *Wurdack 34957* (NY); Caracas, *Fendler* (G), *Al. Braun 1215,* type of *M. braunianum* (G), the same, *1213* (G); Estado Bolívar, Chimantá Massif, *Steyermark 74966, 75217* (US).

BRAZIL: Caldas, *G. A. Lindberg* (NY); *Petrópolis, Doring* (G); Paraná, *Dusén 3869* (as *M. portoricense*) (G); S. Catarina, *Carl 145* (Hb. Herzog); Apiahy, *Puiggari 296 III* (as *M. portoricense*) (G); Minas Gerais: Caraça, *Wainio 12* (as *M. arcuatum*) (G).

ECUADOR: Mt. Tunguarahua, *Spruce, Hep. Spruc.,* type of *M. verrucosum* (isotype FH); *Spruce, Hep. Spruc.,* type of *B. flavicans* (isotype FH); *Spruce, Hep. Spruc.,* type of *B. vincentina* var. *subrectifolia* p.p. (isotype NY); Manobi, *Wallis* (as *M. arcuatum*) (G).

PERU: Cuzco, without collector, as *M. schlimianum* (FH, G); s.l., *Weddell,* type of *M. superbum* (G).

BOLIVIA: Tablas, 1800 m, *Herzog 4620,* type of *M. douini* (G); Tocorani, 3000 m, *Herzog 3841a* (G); Yungas, 6000 ft, *Rusby 2029* (as *M. portoricense*) (G), *Rusby 3023* (NY); N. Yungas, 1300 m, *Buchtien 17202* (Hb. Herzog).

This widespread species is abundant throughout the hilly or mountainous areas of the tropics. When the plants are large and well developed they are readily recognized, but the smaller forms are more difficult since they may be confused with large plants of *B. breuteliana.* The cells are a little larger, the trigones are larger and conspicuous, and the cuticle is more coarsely verruculose in *B. hookeri.* There are also small differences which are difficult to evaluate. The scale-leaves of the flagelliform branches are very small and inconspicuous in *B. breuteliana* while they are much larger and broader than the stem in *B. hookeri.* The large scale-leaves will also serve to separate small plants of this species from *B. arcuata* or other members of the section *Grandistipulae.*

44. **Bazzania robusta** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 378. 1885.

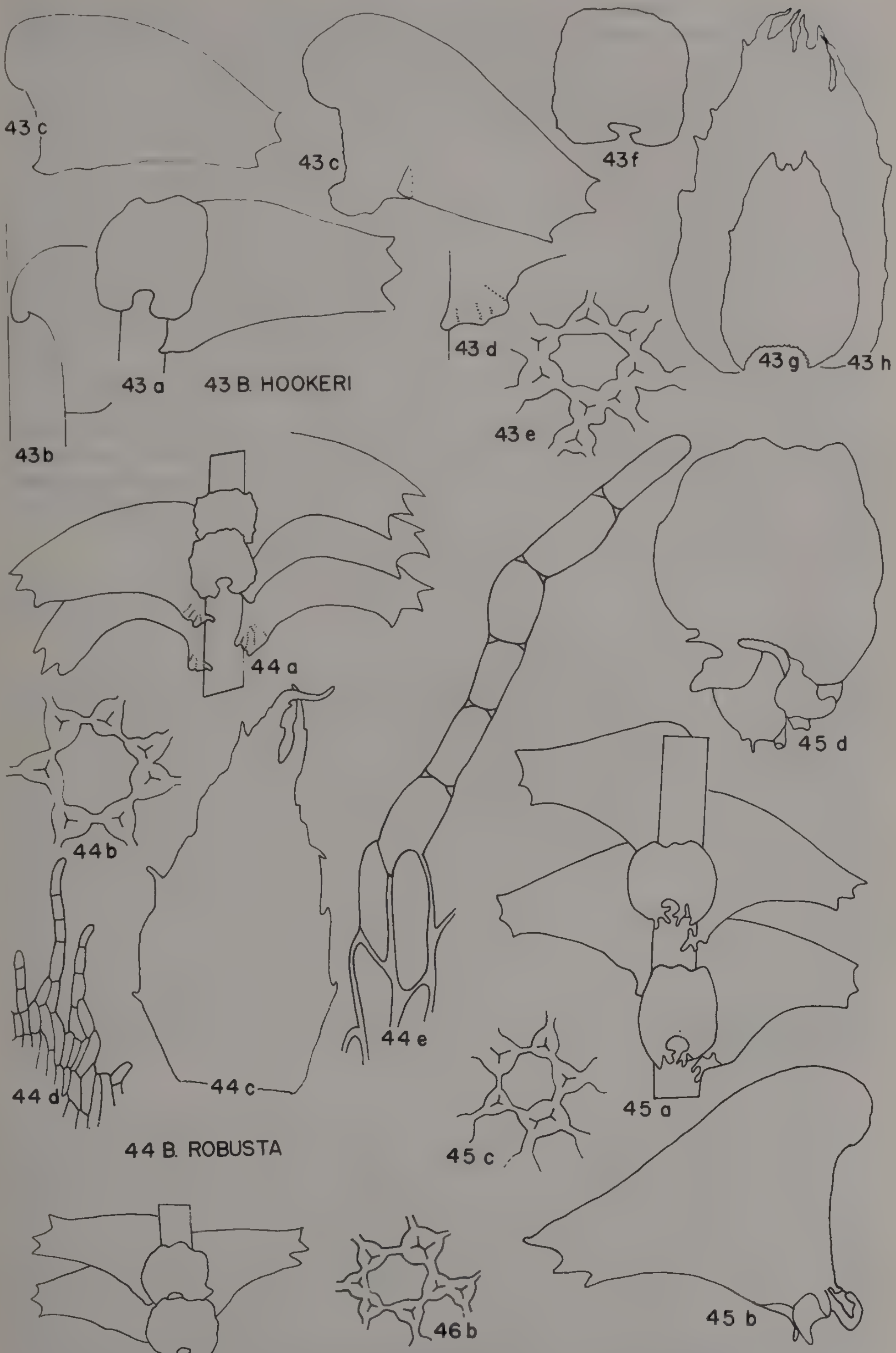
Mastigobryum robustum Stephani, Spec. Hep. **3**: 501. 1908.
Mastigobryum javitense Stephani Spec. Hep. **3**: 528. 1909.

FIG. 43. *Bazzania hookeri.* 43 a. Stem, ventral view, × 15. 43 b. Leaf insertion on the stem. 43 c. Leaves, × 15. 43 d. Ventral auricle of a leaf, × 30. 43 e. Leaf-cell, × 400. 43 f. Underleaf, × 15. 43 g, h. Female bracts of the outer (g) and innermost (h) series, × 40.

FIG. 44. *B. robusta.* 44 a. Stem, ventral view, × 15. 44 b. Leaf-cell, × 400. 44 c. Female bract of the innermost series, × 30. 44 d. Portion of the perianth-mouth, × 90. 44 e. One of the cilia of the perianth-mouth, × 300.

FIG. 45. *B. boliviana.* 45 a. Stem, ventral view, × 15. 45 b. Leaf, × 35. 45 c. Leaf-cell, × 350. 45 d. Underleaf, × 35.

FIG. 46. *B. liebmanniana.* 46 a. Stem, ventral view, × 15. 46 b. Leaf-cell, × 400.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44 e
45 d
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45 c
45 b
46 a
46 b

43 B. HOOKERI

44 B. ROBUSTA

46 B. LIEBMANNIANA

45 B. BOLIVIANA

Plants large, yellow-brown, becoming deeply pigmented in the older portions; stems robust, 10 cm or more in length, with leaves to 5 mm broad; lateral branches frequent, 1 cm or more apart, diverging at a wide angle; flagelliform branches frequent, long, the scale-leaves large, ovate, broader than the branch. Leaves densely imbricate, strongly deflexed when dry, asymmetrically ovate, strongly falcate, 2.5–3.5 mm long, 1.5 mm broad at the base, narrowed to the mostly transversely truncate, tridentate apex; the dorsal margin arched from a cordate base, the ventral auricle large, undulate, or with an occasional tooth, without appendages; teeth spreading, long, acute to acuminate, eight to ten cells long, four to six-cells broad at the base, the margins entire, undulate; leaf-cells thin-walled, becoming thickened, the trigones very large, knot-like, the pits narrow, the cell walls often obliterated by the enlarging trigones, the lumina stellate, the cuticle faintly verruculose; cells of the apical portion large, 32–36 × 24 μ. Underleaves imbricate, large, round-quadrate, averaging 0.6 mm, long and broad, the base cordate, the auricles mostly rounded, entire, undulate, lobed or faintly toothed, the lateral and apical margins undulate, faintly lobed, obscurely toothed to entire. Female branches occasional, the bracts of the intermediate and innermost series long-ovate, divided to one-fourth or one-sixth their length into two or three slender, serrate to spinose laciniae, with cells to 64 mm long, thin-walled. Perianth to 6 cm long, the mouth ciliate-laciniate, the cells to 64 μ long, thin-walled. Male branches and sporophyte not seen. Fig. 44, a–e.

Habitat: In humid forests, in deep ascending tufts, on decaying logs and rocks and on trunks and branches of trees.

COLOMBIA: Río Apoporis, *Schultes & Cabrera 12345, 15354* (FH); Río Kananarí, *Schultes & Cabrera 13200a* p.p. (FH); Río Miritiparaná, *Schultes & Cabrera 16552* (FH), Río Piraparaná, *Schultes & Cabrera 17097* (FH).

VENEZUELA: Serrania Parú, *Cowan & Wurdack 31429* (NY).

BRITISH GUIANA: near Baitica Grove, *Jenman* (NY).

BRAZIL: Panuré along Rio Negro, *Spruce, Hep. Spruc.* (isotypes G, NY); Rio Uaupés, *Spruce, Hep. Spruc.* [B 20] (G); Santos, *Mosén* (FH).

PERU: Andes Peruv.; sylva Javitá, *Spruce*, type of *M. javitense* (G); s.l., *Weberbauer 1248* (G).

BOLIVIA: Santa Ana, *Williams 2161* (YU, NY).

45. Bazzania boliviana (Stephani) Fulford, Bull. Torrey Club 86: 404. *f. 94–99.* 1959.

Mastigobryum bolivianum Stephani in Herzog, Biblioth. Bot. **87**: 223. *f. 164, f–h.* 1916.

Plants of medium size to large, in yellow to dark brown mats; stems to 12 cm long, with leaves to 3 mm broad; lateral branches distant, forming an acute angle with the stem; flagelliform branches frequent, the scale-leaves broader than the branch, ovate, 0.24 mm long. Leaves densely imbricate, to 2.3 mm long. to 2 mm broad at the base, narrowed to 0.8 mm broad at the obliquely truncate tridentate apex, the dorsal margin arched from the cordate base which extends across the stem, the ventral auricle large, incised and appendiculate, the ventral margin arched but ascendent; teeth unequal, six to ten cells long, six to ten cells broad at the base, the basiscopic tooth the smallest; leaf-cells thin-walled. the trigones conspicuous with bulging sides and becoming coalesced or separated only by narrow pits, the lumina angular-rounded, the cuticle faintly verruculose; cells of the apical portion 22–24 μ, rarely to 27 μ, in diameter. Underleaves large, broader than the stem, subquadrate to longer than broad, averaging 1.2 mm long, 0.9 mm broad, the base cordate, with very large, incised auricles and long appendages similar to those of the ventral auricle of the leaf, the lateral and apical margins undulate or lobed and with occasional short teeth or rarely with longer teeth. Sexual branches and sporophytes not seen. Fig. 45, a–d.

Habitat: In mats on logs.

COLOMBIA: Santander, *H. Bischler 83* (Hb. Bischler); San Cristobal, Bogotá, *La-Couture 33* (as *M. humifusum*) (G).
VENEZUELA: Estado Bolívar, Chimantá Massif, *Steyermark, 75130, 75131* (NY).
BRAZIL: Rio Uaupes, *Spruce* [*B 34*] (as *B. spinigera*), *Hep. Spruc.* (G).
ECUADOR: Gualiquiza, *Allioni*, Hb. Levier 6402, 6403 (G).
PERU: Junin, 2700 m, *Weberbauer 2304* (as *B. ancistrodes*) (G); Chimborazo, *Spruce, Hep. Spruc.* (as *B. ancistrodes*) (G).
BOLIVIA: Corani, 2600 m., *Herzog 5072* (type G).

This species is readily recognized by its rather short leaves nearly as broad at the base as they are long, with very narrow, 3-toothed apices, and the large, incised, and appendiculate auricles on the ventral base of the leaf and the cordate base of the underleaves.

46. **Bazzania liebmanniana** (Lindenberg & Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum liebmannianum Lindenberg & Gottsche in G. L. & N. Syn. Hep. 719. 1847.

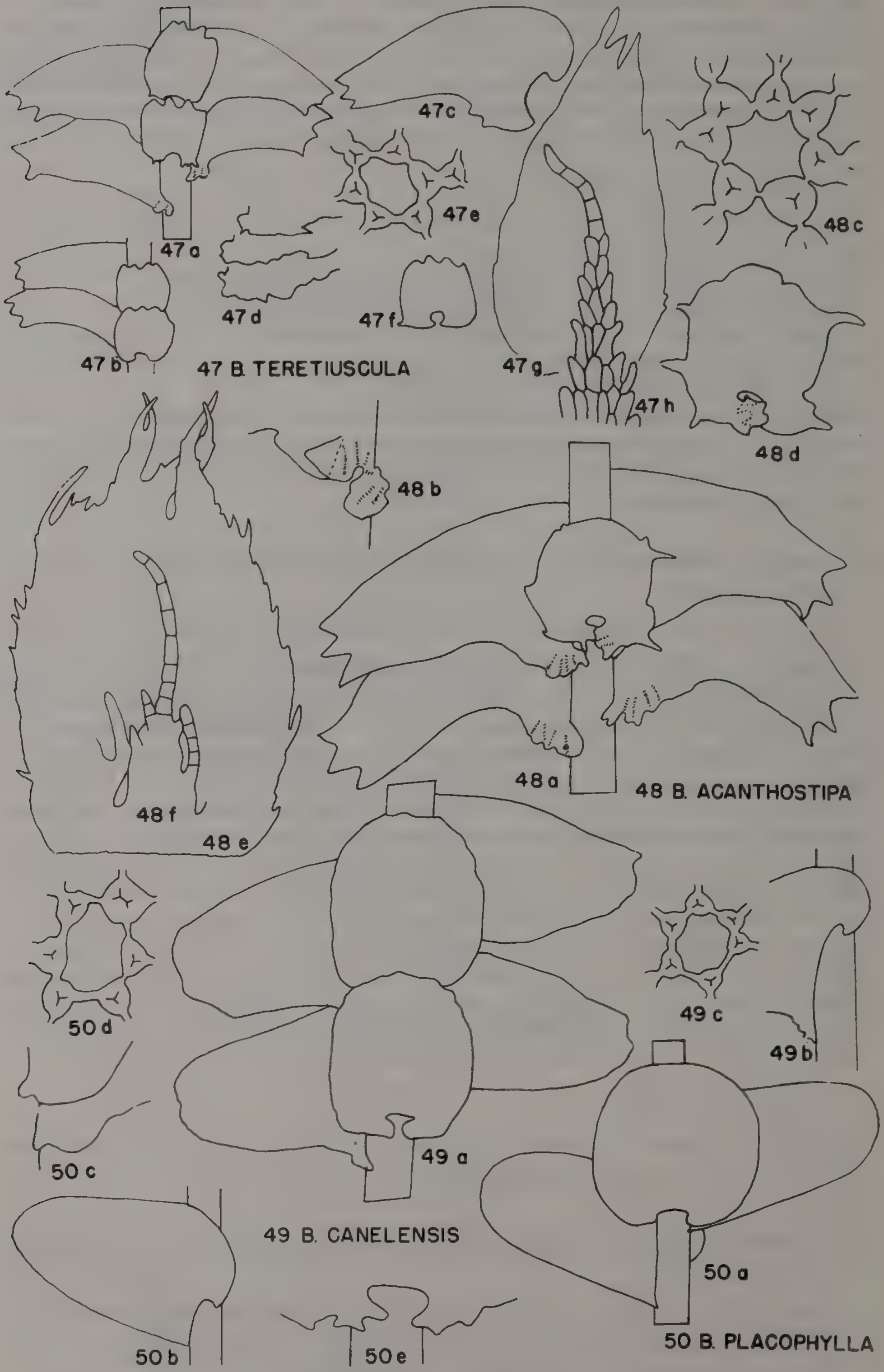
Plants of medium size, light brownish-green becoming darker; stems slender, 5 cm or more in length, with leaves to 4 mm broad; lateral branches diverging at a wide angle; flagelliform branches frequent, the scale-leaves tiny, not as broad as the branch, to 0.2 mm long, ovate. Leaves imbricate, strongly deflexed when dry, asymmetrically ovate, spreading, 1.5–2.5 mm long, 1–1.5 mm broad at the base, narrowed to the transversely to obliquely truncate, tridentate apex, the dorsal margin strongly arched from a cordate base, the ventral auricle conspicuous, undulate, lobed, or occasionally toothed, the ventral margin arched, ascendent; teeth variable, four to six cells long, four to six cells broad at the base, the margins entire; leaf-cells thin-walled, the lumina angular-rounded, the trigones conspicuous, with convex sides, often becoming coalesced, the cuticle faintly verruculose; cells of the apical portion averaging 20 μ. Underleaves imbricate, subquadrate, 0.6–0.85 mm long and broad, the base cordate, the lateral margins repand, sometimes with one to several large teeth, the apex variously lobed or toothed. Sexual branches and sporophyte not seen. Fig. 46, a–b.

Habitat: Not given.

MEXICO: Oaxaca, *Liebmann* (type G, isotype FH, very poor); Vera Cruz, *Purpus 5548* (YU).
GUATEMALA: Cobán, *Standley 69119* (US).

47. **Bazzania teretiuscula** (Lindenberg & Gottsche) Trevisan, Mem. Ist. Lomb. **13**: 414. 1877.

Mastigobryum teretiusculum Lindenberg & Gottsche in G. L. & N. Syn. Hep. 720. 1847.
Bazzania heteroclada Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 379. 1885.
Bazzaria spinigera Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 380. 1885.
Bazzania humifusa Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 379. 1885.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50 e

47 B. TERETIUSCULA

48 B. ACANTHOSTIPA

49 B. CANELENSIS

50 B. PLACOPHYLLA

Mastigobryum humifusm Stephani, Hedwigia **44**: 225. 1905.
Mastigobryum heterocladum Stephani, Spec. Hep. **3**: 502. 1908.
Mastigobryum spinigerum Stephani, Spec. Hep. **3**: 500. 1908.
Bazzania conchophylla Herzog, Rev. Bryol. Lichénol. **11**: 20. 1938.
Mastigobryum incisostipulum Stephani in Herzog, Biblioth. Bot. **87**: 225. *f. 165, c–d.* 1916.

Plants of medium size, greenish-brown becoming deeply pigmented with brown; stems to 8 cm long, with leaves to 3.2 mm broad, suberect; lateral branches 5 mm or more apart, diverging at a wide angle; flagelliform branches frequent, the scale-leaves small, not as broad as the branch. Leaves approximate to imbricate, deflexed, strongly so when dry, asymmetrically ovate, straight to subfalcate, 1.2–2.2 mm long, to 1 mm broad at the base, narrowed to the more or less obliquely truncate, tridentate apex, the dorsal margin strongly arched from a cordate base, the ventral auricle undulate, entire, toothed, ciliate or appendiculate; teeth mostly spreading, acute, five to eight cells long, four to six cells broad at the base, the margins entire; leaf-cells thin-walled, the cell lumina angular-rounded, the trigones conspicuous, with convex sides, often confluent, the cuticle faintly verruculose; cells of the apical region averaging 20 × 20 μ. Underleaves approximate to imbricate, subquadrate in outline, averaging 0.7 mm long and broad, the base cordate, the auricles rather small, not overlapping, rounded, their margins entire or dentate with one or two broad teeth, or ciliate by a row of two or three cells, the lateral margins convex, entire or rarely with one or two teeth, the apex deeply four-lobed or -toothed, with narrow, acute sinuses. Female branches occasional, the bracts of the intermediate and innermost series long-ovate, divided to one-fifth or one-sixth their length into three, serrate, ciliate laciniae, the cells mostly 36 × 16 μ, the cell walls thin. Male branches, perianths, and sporophytes not seen. Fig. 47, a–h.

Habitat: On rocks and bases of trees on shaded slopes in moist forests.

MEXICO: Vera Cruz, Hacienda de Mirador, *Liebmann*, (type G); s.l., *Karsten 94* (as *M. portoricense*) (G); s.l., *Sumichrast* (G); Chiapas: near Mapastepec, *Sharp 4558* p.p. (TENN).

COSTA RICA: La Estrella, *Standley 39426* (US); San José, *Standley 41629* (US); Cartago, *Standley 50, 884* (US).

COLOMBIA: Cordillera Macarena *Schultes & Bell 11655* (FH).

VENEZUELA: Cerro Huachamacare, *Maguire, Cowan & Wurdack 30270* (NY).

BRAZIL: Rio Tarumá at the Rio Negro, *Spruce, Hep. Spruc.*, type of *B. spinigera* (isotype NY); s.l., *Ule 140* (as *M. portoricense*) (G); Rio de Janeiro, *Schiffner 836* (W). S. Paulo: near Itapecerica, *Schiffner 1264* p.p. (W); Alto da Serra, *Schiffner 1706* (W); near Santos, *Schiffner 1939* p.p., *1953* (W).

PERU: Mt. Guayrapurina, *Spruce, Hep. Spruc.*, type of *B. heteroclada* (isotype NY); Mt. Campana, *Spruce, Hep. Spruc.*, type of *B. humifusa* (isotype NY), *Spruce* (as *M. teretiusculum* and *B. otites*) (G).

FIG. 47. *Bazzania teretiuscula.* 47 a. Stem, ventral view, × 15. 47 b. Another stem, × 15. 47 c. Leaf, × 15. 47 d. Ventral auricles of three leaves, × 30. 47 e. Leaf-cell, × 400. 47 f. Underleaf, × 15. 47 g. Female bract of the intermediate series, × 30. 47 h. Lacinia of a bract of the innermost series, × 100.

FIG. 48. *B. acanthostipa.* 48 a. Stem, ventral view, × 15. 48 b. Ventral auricle of a leaf, × 30. 48 c. Leaf-cell, × 400. 48 d. Underleaf, × 15. 48 e. Female bract of the innermost series, × 30. 48 f. Portion of the perianth-mouth, × 90.

FIG. 49. *B. canelensis.* 49 a. Stem, ventral view, × 15. 49 b. Leaf insertion, × 15. 49 c. Leaf-cell, × 400.

FIG. 50. *B. placophylla.* 50 a. Stem, ventral view, × 15. 50 b. Leaf and stem, dorsal view, × 15. 50 c. Ventral auricles of two leaves, × 40. 50 d. Leaf-cell, × 350. 50 e. Base of an underleaf, × 40.

This highly variable species may be recognized by the hook-form insertion of the dorsal base of the leaf, the conspicuous but rarely toothed ventral auricle; the large, subquadrate underleaves which are often conspicuously four-lobed, above and cordate at the base with a spine or tooth from one or both of the auricles.

48. **Bazzania acanthostipa** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 381. 1885.

Mastigobryum acanthostipum Stephani, Spec. Hep. **3**: 499. 1908.

Plants large, light brown, greenish in the younger portions; stems robust, to 14 cm in length, with leaves to 5 mm broad; lateral branches occasional, diverging at a wide angle; flagelliform branches frequent, long, the scale-leaves small. Leaves densely imbricate, deflexed when dry, asymmetrically ovate, falcate, 2.5–3.5 mm long, 2 mm broad at the base, narrowed to the mostly transversely truncate, more or less equally tridentate apex, the dorsal margin arched from a cordate base, the ventral auricle very large, undulate, lobed, toothed, often appendiculate; teeth spreading, long, broadly triangular, acute, eight to fifteen cells long, four to six cells broad at the base, the sinuses deep, lunulate, the margins entire, repand; leaf-cells thin-walled but the wall obscured by the enlarged trigones, the lumina stellate, the trigones very large, with convex sides, the cuticle faintly verruculose; cells of the apical portion 20 × 20 μ. Underleaves imbricate, subquadrate, averaging 1.2 mm long and broad, the base cordate-auriculate, the auricles very large, overlapping, undulate, serrate, lobed, toothed, or appendiculate, the lateral margins coarsely toothed or lobed, and with one or more broad to narrow, apiculate, widely spreading teeth, the apical margin convex, undulate, sometimes four-lobed. Female branches occasional, the bracts of the intermediate and innermost series long-ovate, divided to one-fourth of their length into three ciliate and serrate laciniae, the lateral margins serrate to long-ciliate, the cells to 64 μ long, with thickened walls. Perianth to 6 mm long, the mouth ciliate-laciniate, the cells averaging 32 μ long, thick-walled. Male branches and sporophyte not seen. Fig. 48, a–f.

Habitat: In deep ascending tufts on rocks and trees in moist places in the mountains.

COLOMBIA: s.l., *A. Wallace* (NY); Río Apoporis, *Schultes & Cabrera 11958* (FH).
PERU: Mt. Campana, *Spruce, Hep. Spruc.* (isotypes G, NY).
BOLIVIA: Mapiri, *Rusby 3027* p.p. (NY).

49. **Bazzania canelensis** (Stephani) Fulford, *Bazzania* Cent. S. Am. 152. *f.* 55. 1946.

Bazzania vincentina var. *submutica* Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 378. 1885.
Mastigobryum canelense Stephani, Spec. Hep. **3**: 518. 1909.
Bazzania vincentina var. *subedentata* Spruce ms., *Hep. Spruc.*

Plants large, olive-green to yellow-brown, becoming more deeply pigmented; stems large, to 10 cm or more in length, with leaves to 5 mm broad, ascending to erect; lateral branchs rare, diverging at a wide angle; flagelliform branches frequent, short, with tiny scale-leaves. Leaves approximate to imbricate, plane, becoming a little deflexed when dry, asymmetrically ovate to oblong, straight, 2.5–3 mm long, 1.5 mm broad at the base, narrowed a little to the broadly rounded to faintly tridentate apex, the dorsal margin strongly arched from a cordate base, the ventral auricle large, undulate, sometimes lobed, the margin entire to serrulate; leaf-apex broad, rounded or undulate to 3-lobed or -toothed, the lobes or teeth broad, short, the sinuses broad, lunulate, the margins entire; leaf-cells thin-walled, the lumina angular-rounded, the trigones small, conspicuous, sometimes becoming coalesced, the cuticle smooth to faintly verruculose; cells of the apical region averaging 16–20 μ. Underleaves approximate to subimbricate, subquadrate to longer than broad, 1.5–2 mm broad, the base strongly cordate, the auricles large, overlapping or nearly so, the margins entire, undulate, the lateral margins convex, the apical margin rounded, undulate, slime papillae present in the depressions. Sexual branches and sporophyte not seen. Fig. 49, a–c.

Habitat: In deep tufts on tree trunks and branches in forests.

ECUADOR: Canelos, *Spruce, Hep. Spruc.* (isotypes FH, G, NY), *Spruce, Hep. Spruc.*, type of *B. vincentina* var. *subedentata* (isotype NY).

50. **Bazzania placophylla** (T. Taylor) Grolle, Rev. Bryol. Lichénol. **27**: 54. *f. 1–5.* 1958.

Jungermannia placophylla T. Taylor, London Jour. Bot. 5: 276. 1846.

Plants large, in deep olive-green to yellow-brown tufts; stems large to 10 cm or more long, with leaves to 3 mm broad; lateral branches scarce, diverging at an acute angle; flagelliform branches not seen. Leaves approximate to slightly imbricate, spreading, the sides nearly parallel, rounded at the broad apex, averaging 1.5 mm long, 0.95 mm wide, the margins entire, the dorsal margin arched from a cordate base and hook-form insertion, extending across the stem and beyond, the ventral base only a little dilated, the small auricle undulate; cells appearing in rows in the upper part of the leaf, averaging 18 μ, thin-walled, the trigones large with convex sides, coalesced or separated by thin-walled pits, the lumina angular-rounded to stellate, the cuticle roughly verruculose. Underleaves approximate to imbricate, very large, round-quadrate to longer than broad, averaging 1.1 mm across, the base straight to the line of insertion or rounded or slightly cordate-auriculate, the lobed margin entire, the cells as in the leaf. Sexual branches, and sporophytes not seen. Fig. 50, a–e.

Habitat: "Mountain slopes on the east side of the Cordilleras of Peru."

ECUADOR: Quito, *Jameson 12* (BM).
PERU: "East declivity of the Cordilleras of Peru" *Jameson* (type S-PA, isotype W).

51. **Bazzania macrostipula** Fulford, Bull. Torrey Club **86**: 407. *f. 107–112.* 1959.

Plants large, olive-green becoming yellow-brown in the older portions; stems to 10 cm or more in length, to 6 mm broad; lateral branches rare, diverging at an acute angle; flagelliform branches not seen. Leaves imbricate, spreading, often becoming somewhat decurved near the tip, tending to be asymmetric, the ventral margin nearly straight, broadly ovate, to 3.5 mm long, 2 mm broad at the base, narrowed to 0.5 mm at the truncate, usually tridentate apex, the dorsal margin strongly arched from a cordate base and hook-form insertion, extending across the stem and beyond, the ventral base enlarged, forming an auricle with several teeth and long appendages, often recurved, the leaf margins obscurely serrulate here and there; teeth equal or with the basiscopic tooth smaller, mostly ten to twelve cells long and broad at the base, the tip a spine of one or two cells, the sinuses lunulate, the margins more or less obscurely serrate; leaf-cells thin-walled but becoming thick-walled, the lumina rounded, the trigones small and coalesced, the cuticle smooth to faintly verruculose; cells of the apical portion 16–18 μ, uniform, those of the interior and base larger. Underleaves approximate, broadly ovate, mostly 1 mm long, 1.5 mm broad at the strongly cordate base, the auricles large, approximate, undulate, with several long or short tooth-like appendages, or rarely incised, the lateral and apical margins undivided, obscurely serrate. Male branches short. Female inflorescence and sporophyte not seen. Fig. 51, a–c.

Habitat: Not given.

ECUADOR: s.l., *Fraser* 1 (type BM); s.l., *Fraser* (ex Hb. Levier 1228) (as *M. superbum*) (G).

Section 5. Vittatae

The plants of this section have three-toothed leaves (often obscurely so in *B. nitida* and *B. heterostipa*), in which a vitta of several rows of elongate cells with conspicuous trigones is more or less well developed. The line of leaf insertion is curved in the upper half, the underleaves are never attached to the leaves, and enlarged appendages are never developed on the leaves or underleaves.

The American species are of medium size to small, and tend to form a clearly distinct unit within the genus, yet some of the species, namely the *B. nitida-B. heterostipa* complex, are not so clearly delimited. Because of the generally Antarctic distribution of most of the species, it would seem that the group as a whole is an ancient one.

52. **Bazzania spruceana** Stephani, Hedwigia **32**: 213. 1893.

Bazzania planiuscula Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 376. 1885. (quoad pl. Guayrapurina.)

Mastigobryum spruceanum Stephani, Spec. Hep. **3**: 469. 1908.

Mastigobryum burchelii Stephani, Spec. Hep. **3**: 509. 1908.

Plants small, brownish-green becoming brown; stems slender, 3 cm or more long, with leaves to 2 mm broad; lateral branches frequent, 2 mm or more apart, diverging at a wide angle; flagelliform branches occasional. Leaves vittate, imbricate, plane, subrectangular, ascendent, 0.7–0.9 mm long, 0.4 mm broad at the base, narrowed a little to the mostly transversely truncate, tridentate apex: teeth acute, spreading, two to five cells long, two to six cells broad at the base, the margins entire, the leaf-cells round-quadrate in outline, the walls uniformly thickened, the lumina rounded, trigones inconspicuous or absent except in the cells of the vitta, the cuticle very strongly verruculose; cells of the apical region 16–22 μ, those of the vitta to 48 × 24 μ. Underleaves distant to imbricate, subquadrate in outline, a little broader than the stem, mostly 0.35 μ long and broad. the apex entire, crenate, undulate or 2–4-lobed. Sexual branches not seen. Fig. 52, a–c.

Habitat: Not given.

PERU: Mt. Guayrapurina, *Spruce* (isotypes G, FH).

BRAZIL: s.l., *Burchell 3847* p.p., *Pl. Brasil Trop.*, type of *M. burchelii* cited incorrectly as from "Fretum Magellanicum" (NY).

52. Bazzania tayloriana (Mitten) Fulford, *Bazzania* Cent. S. Am. 157. *f. 57.* 1946.

Mastigobryum taylorianum Mitten in J. D. Hooker, Bot. Ant. Voy. 2^2 (Fl. N. Zel.): 147. *pl. C, f. 5.* 1854.

Plants small, pale, glaucous-green, becoming deeply pigmented with brown; stems slender, delicate, to 3 cm or more in length, with leaves mostly 1.5 mm broad, prostrate; lateral branches occasional, diverging at a wide angle, the ventral branches frequent, usually leafy. Leaves approximate to subimbricate, vittate, spreading, plane, becoming somewhat deflexed beyond the middle, subrectangular, 0.7–1.0 mm long, mostly 0.5 mm broad at the base, little narrowed to the transversely truncate, conspicuously tridentate apex; teeth large, spreading, eight to ten cells long, four to six cells broad at the base, the sinuses deep, acute to rounded, the margins entire; leaf-cells quadrate in outline, uniformly thick-walled except those of the vitta, the lumina rounded, the cuticle very abundantly minutely punctate; cells of the apical portion mostly 16 × 16 μ, of the vitta, to 32 × 24 μ, the walls thin, the trigones conspicuous. Underleaves distant, hyaline throughout or a few cells at the base chlorophyllose, suberectangular in outline, broader than the stem above, 0.22–0.35 mm long, to 0.28 mm broad above, divided from one-half to one-fourth or less into usually four equal, blunt teeth, four to ten cells long, two or four cells broad, the sinuses acute, the margins entire, the cells quadrate to rectangular in outline, hyaline, the walls uniformly thickened. Sexual branches and sporophyte not seen. Fig. 53, a–d.

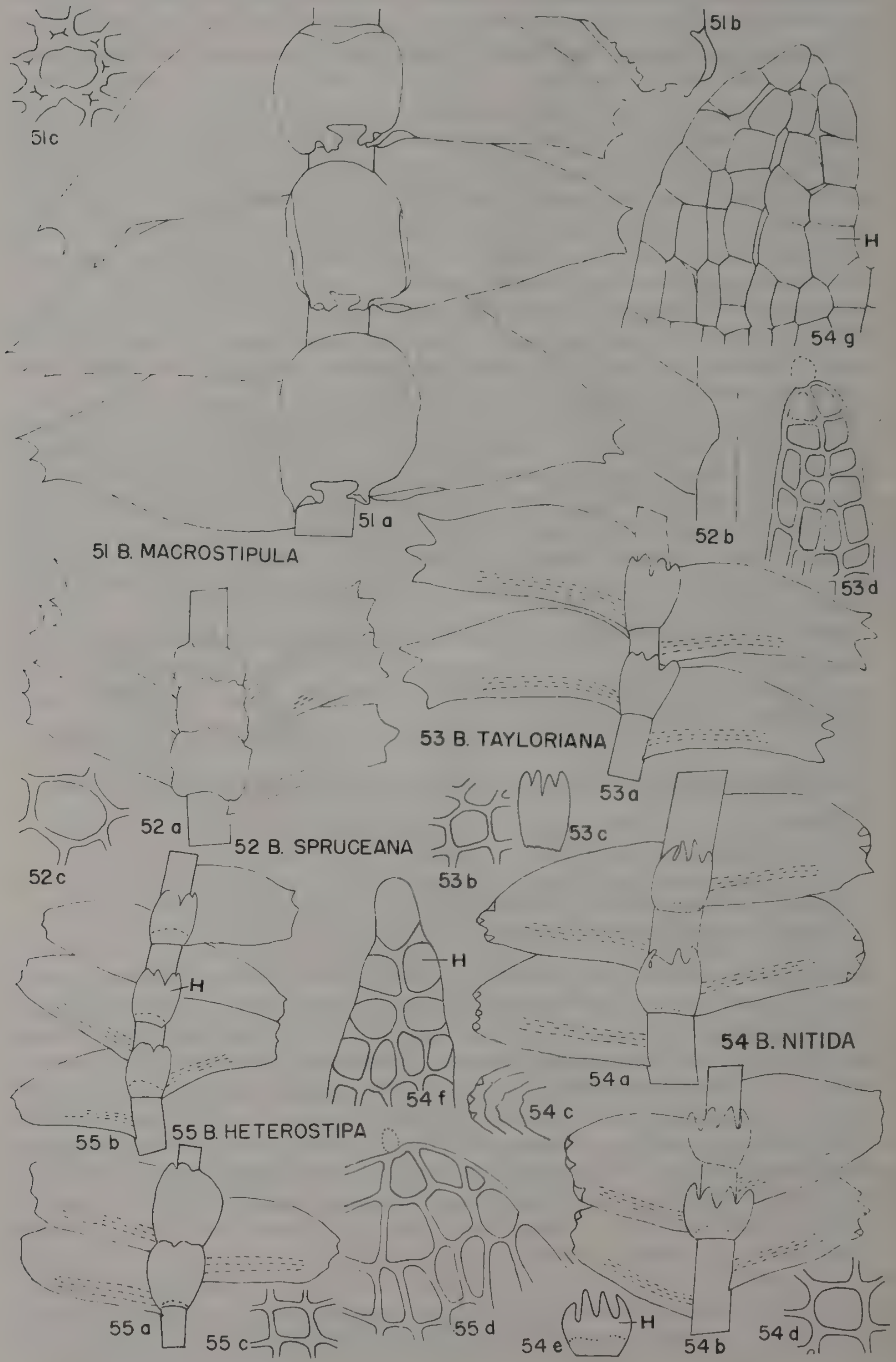
Habitat: In depressed mats on soil or logs among other bryophytes.

COLOMBIA: Bogotá, 4000 ft, *Weir* (NY).
NEW ZEALAND: North Island, *Zotov* (NY); N. Island, *Colenso* (type NY); *Sinclair* (NY); Kaipara, *Mossman 760d* (NY).

54. Bazzania nitida (Weber) Grolle, Revue Bryol. Lichénol. **29**: 210. 1960.

Jungermannia convexa Thunberg, Prodr. Pl. Cap. 173. 1794.
Jungermannia nitida Weber, Prodr. 43. 1815.
Mastigobryum richardianum Mitten in Hooker, Bot. Ant. Voy. 2^2 (Fl. N. Zel.): 147. 1854.
Bazzania convexa (Thunberg) Trevisan, Mem. Ist. Lomb. 13: 414. 1877.
Bazzania carlii, Herzog, Beih. Bot. Centr. Abt. B. **61**: 565. *f. 1, e–h.* 1942.

Plants pale, whitish to yellow-green; stems very slender, to 3 cm or more in length, with leaves to 1.5 mm broad, prostrate; lateral branches few, diverging at a wide angle, ventral branches frequent, usually leafy, sometimes flagelliform. Leaves vittate, spreading, approximate to subimbricate, nearly straight, the teeth and a little of the apical portion usually deflexed, asymmetrically ovate, 0.7–0.9 mm long, mostly 0.35 mm broad at the base, narrowed a little to the transversely truncate, mostly obscurely tridentate (often entire), decurved apex; teeth short-triangular, one or two cells long and wide, the sinuses lunulate, the margins entire; leaf-cells quadrate to rectangular in outline with uniformly thickened walls except the cells of the vitta, the lumina rounded, the cuticle verruculose; cells of the apical portion, margins, and dorsal base averaging 16 × 16 μ, those of the vitta to 32 × 24 μ, with thin walls and conspicuous trigones. Underleaves distant, hyaline above, subquadrate in outline, averaging 0.28 × 0.28 mm, mostly one-third to one-half divided into four more or less equal, acute teeth, the teeth mostly five cells long, two to four cells broad at the


51 c
51 b
H
54 g
51 a
52 b
51 B. MACROSTIPULA
53 d
53 B. TAYLORIANA
53 a
52 a
52 B. SPRUCEANA
52 c
53 b
53 c
H
H
54 B. NITIDA
54 a
54 f
54 c
55 b
55 B. HETEROSTIPA
55 a
55 c
55 d
54 e
H
54 b
54 d

base, the sinuses acute, the margins entire, the chlorophyllose cells restricted to a small, interior, basal area, similar to those of the margins of the leaf, the hyaline cells larger, more or less rectangular in outline, averaging 18–22 μ long and wide, the walls uniformly thickened. Sexual branches and sporophytes not seen. Fig. 54, a–g.

Habitat: On soil and among rocks in mats or intermingled with other bryophytes.

BRAZIL: Organ Mountains, *Gardner* (NY); S. Paulo: Barra Mansa, *Schiffner 536, 577, 1801, 1817, 1850* (W); near Santos, *Schiffner 1956* (W); S. Catarina, *Carl*, type of *B. carlii* (Hb. Herzog).

CHILE-PATAGONIA: Chiloe Island, *Captain King* (NY); Albert Bay, *Dr. Coppinger* (NY); Straits of Magellan: *Richard*, type of *M. richardianum* (NY).

Also Africa, Australia.

55. Bazzania heterostipa (Stephani) Fulford, Bull. Torrey Club **86**: 410. 1959.

Mastigobryum heterostipum Stephani, Spec. Hep. 3: 532. 1909.

Bazzania stephani Fulford, *Bazzania* Cent. & S. Am. 162. *f. 59.* 1946. Non *Mastigobryum stephani* Jack in Stephani.

Plants pale yellow-green to brownish; stems very slender, to 3 cm or more in length, with leaves to 1.5 mm broad, prostrate; the lateral branches occasional, diverging at a wide angle; ventral branches frequent, usually leafy. Leaves vittate, approximate to subimbricate, spreading, plane, the teeth and a little of the apical portion often deflexed, asymmetrically oblong-ovate, 0.7–0.9 mm long, mostly 0.35 mm broad at the base, narrowed a little to the transversely truncate, obscurely tridentate or entire apex; teeth one or two cells high, two to four cells broad at the base, the sinuses lunulate, the margins entire; leaf-cells quadrate to rectangular in outline, with uniformly thickened walls, the lumina rounded, the cuticle verruculose; cells of the apical portions averaging 16 × 16 μ, those of the vitta to 32 × 24 μ, the walls thin, the trigones conspicuous. Underleaves large, approximate to imbricate, hyaline in part, rectangular in outline, averaging 0.35–0.42 mm long, 0.28 mm wide, the apex undulate, 2–4-lobed or -toothed, the chlorophyllose cells restricted to a small, interior, basal area, the cells quadrate to rectangular in outline, with uniformly thickened walls. Sexual branches and sporophyte not seen. Fig. 55, a–d.

Habitat: Over rocks and soil, in mats or tufts or scattered among other bryophytes.

BRAZIL: Blumenau, *Ule 168* (lectotype G, isotype FH); without locality, *Ule 40* (G);

Fig. 51. *Bazzania macrostipula.* 51 a. Stem, ventral view, × 15. 51 b. Ventral auricle of a leaf, × 40. 51 c. Leaf-cell, × 350.

Fig. 52. *B. spruceana.* 52 a. Stem, ventral view, × 15. 52 b. Leaf insertion on the stem. 52 c. Leaf-cell, × 300.

Fig. 53. *B. tayloriana.* 53 a. Stem, ventral view, × 30. 53 b. Leaf-cell, × 400. 53 c. Underleaf, × 30. 53 d. Tooth of an underleaf, the cuticle punctate, × 300.

Fig. 54. *B. nitida.* 54 a. Stem, ventral view, × 30. 54 b. Another stem, × 30. 54 c. Apices of leaves, × 30. 54 d. Leaf-cell, × 400. 54 e. Underleaf, × 30; H, hyaline part. 54 f. Hyaline tooth of an underleaf, × 300. 54 g. Two teeth (hyaline), of another underleaf, × 300.

Fig. 55. *B. heterostipa.* 55 a. Stem, ventral view, × 30. 55 b. Another stem, × 30; H, hyaline part of an underleaf. 55 c. Leaf-cell, × 400. 55 d. Upper part (hyaline) of an underleaf, × 350.

Petrópolis, *Didrechson* (G); Apiahy, *Puiggari 766b* (G); without locality, *Burchell 3847* p.p., *Cat. Geogr. Pl. Brazil Trop.* (with *M. burchellii*) (NY); part of the same, incorrectly labeled as *M. richardianum* "Fretum Magellan, no. *3847*, ex Hb. *Burchell*, ex Hb. Kew, Portion du Type" (G). S. Paulo: near Santos, *Schiffner 105*, 1939 (W); Alto da Serra, *Schiffner 181, 1690* (W); Barra Mansa, *Schiffner 495, 1817, 1874* (W); Rio Grande, *Schiffner 707* (W); Itapecerica, *Schiffner 1264* (W); Brasso Grande, *Schiffner 1294, 1309, 1429, 1549, 1557* (W).

No specimens of the following taxa of *Bazzania*, reported from Latin America, have been seen.

Bazzania adnexa (Lehmann & Lindenberg) Trevisan. Reported from Chile.
Bazzania angustifalcata Herzog. Colombia.
Bazzania bidens var. *heterodonta* Spruce. Peru.
Mastigobryum brasiliense Gottsche & Lindenberg. Brazil.
Mastigobryum decurrens Stephani. Bolivia.
Mastigobryum fuegianum Sullivant. Tierra del Fuego.
Bazzania humifusa var. *olivacea* Spruce. Peru.
Bazzania sparreana S. Arnell. Chile.
Herpetium scutigerum Montagne. Peru.
Mastigobryum venezuelanum Molkb. Venezuela.
Bazzania vincentina var. *macrophylla* Spruce. Ecuador.
Mastigobryum platycnemum Schwaegrichen in Stephani. Reported from the Falkland Islands.

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Lindenberg, J. B. G. & Gottsche, C. M. 1851. Species Hepaticarum viii-xi. *Mastigobryum.* i-xi, 1–118.

Stephani, F. 1908. Species Hepaticarum **3**: 413–540. *Mastigobryum.*

————. 1924. Species Hepaticarum **6**: 452–489. *Mastigobryum.*

————. Icones Hepaticarum. *Mastigobryum.* Nos. 1–465. [Unpublished drawings made by Stephani. The originals are at the Conservatoire et Jardin Botaniques at Geneva; duplicate sets have been sold to various herbaria.]

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Margaret H. Fulford

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	2	publ. June, 1966		
	3	In preparation		
14	1	publ. March, 1966	A Taxonomic Revision of the Genus *Persea* in the Western Hemisphere (Perseae-Lauraceae)	Lucille E. Kopp
	2	publ. March, 1966	A Preliminary Account of the North American Species of *Rhizopogon*	A. H. Smith & S. M. Zeller
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(continued on inside back cover)

Memoirs of The New York Botanical Garden Vol. 11(2)

MANUAL

# of the

LEAFY HEPATICAE OF LATIN AMERICA[1,2]

PART II

by

Margaret H. Fulford

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Acromastigum Evans, Bull. Torrey Club **27:** 103. 1900, emend. Evans, Ann. Bryol. Suppl. **3:** 5. 1934.

Mastigobryum β p.p., G. L. & N. Syn. Hep. 218. 1845.
Mastigobryum [sect.] III. *Inaequilatera* Stephani, Hedwigia **25:** 245. 1886.
Bazzania sec. III. *Inaequilaterae* Schiffner in Engler & Prantl, Nat. Pflanzenfam. **1**^{3}: 101. 1893.
Mastigobryum [subg. *Inaequilatera*] Stephani, Bull. Herb. Boissier II. **8:** 404. 1908.

Plants of small to medium size, prostrate to ascending, loosely branched in apparent dichotomies; vegetative branches lateral, leafy, of the *Frullania* type, with the dorsal ovate half-leaf subtending the stem and branch, or ventral flagelliform, of the *Acromastigum* type, with the ovate half-underleaf adjacent to the base of the branch on either side: sexual branches very short, ventral intercalary, in the axils of the underleaves (rarely on flagelliform branches); stem in transverse section with one layer of large cortical cells with thicker walls surrounding the medulla of many smaller cells; leafy branches with a unistratose cortex of only seven large cells with thick walls, surrounding the medulla of many smaller cells. Rhizoids colorless, with branched tips, from the bases of the underleaves, the scales of the flagelliform branches, and the base of the female inflorescence. Line of leaf insertion transverse to oblique, the leaves incubous. Leaves rectangular to ovate in outline, undivided, bidentate or bifid, with the segments unequal or rarely equal, in some species vittate, the cell-walls thickened. Underleaves transversely inserted, undivided, bifid or trifid. Plants dioicous; male branches short, catkin-like, often curved, the bracts smaller than the leaves, usually bidentate, concave, of delicate texture, monandrous, the bracteoles similar, smaller, less concave, without antheridia; female branches without innovations, the bracts and bracteoles different from the leaves, in three or four series, ovate, with two main divisions, variously laciniate, lobate, or dentate, the innermost series the largest. Perianth unistratose (usually), terete below, trigonous above, the keels broad, with the third keel ventral, the mouth more or less plicate, 3-lobed, with marginal laciniae and cilia. Shoot/sporophyte relationship a shoot-calyptra. Capsule oval, the wall of four layers of cells, the outermost layer with brown knot-like thickenings most numerous on the longitudinal radial walls, the innermost layer with crowded brown semi-annular thickenings as bands on the inner tangential walls; elaters bispiral; spores brown, minutely verruculose. Sporophyte stalk of eight longitudinal rows of large cells surrounding many rows of smaller cells.

Type species: *Mastigobryum* (?) *integrifolium* Austin.

The species belong to the section *Inaequilaterae,* in which the cortical cells of the leafy branches are in seven longitudinal rows, the leaves are bifid, and the underleaves trifid.

Key to the Species

1. Ventral segment of the leaf nearly twice as long as the dorsal segment; cell-walls distinctly pigmented with yellow or brown [especially the cortical cells]. 1. *A. anisostomum.*
1. Ventral segment of the leaf as long as or only a little longer than the dorsal segment; cell-walls only faintly pigmented with yellow or without pigmentation.
  2. Segments alike or nearly so, triangular; walls of the leaf-cells thin, with distinct trigones. 2. *A. laetevirens.*
  2. Ventral segment linear, the dorsal segment triangular from a broader base; walls of the leaf-cells thick, without trigones. 3. *A. cunninghamii.*

1. **Acromastigum anisostomum** (Lehmann & Lindenberg) Evans, Ann. Bryol. Suppl. **3:** 48 *f. 9–11.* 1934.

Jungermannia anisostoma Lehmann & Lindenberg in Lehmann, Pug. Pl. **6:** 57. 1834.
Jungermannia atrovirens T. Taylor, London Jour. Bot. **3:** 388. 1844. Non *J. atrovirens* Dumortier, Syll. Jungerm. 51. 1831.
Mastigobryum atrovirens T. Taylor in G. L. & N. Syn. Hep. 218. 1845.
Mastigobryum anisostomum Lehmann & Lindenberg in G. L. & N. Syn. Hep. 219. 1845.
Bazzania anisostoma Trevisan, Mem. Ist. Lomb. III. **4:** 414. 1877.
Bazzania mooreanum Stephani, Hedwigia **33:** 1. 1894.
Mastigobryum mooreanum Stephani, Spec. Hep. **3:** 539. 1909; Icon. Hep., *Mastigobryum No. 488.*
Mastigobryum chiloense Stephani, Sv. Vet.-akad. Handl. **46**^{9}**:** 59. *f. 22, e–h.* 1911; Icon. Hep., *Mastigobryum No. 483.*

Plants in golden, yellowish-, olive-, or reddish-brown to black tufts or depressed mats, or mixed with other bryophytes; stems slender, 2–5 cm long, with leaves to 1.6 mm broad, appearing dichotomously branched; leafy branches 0.5 mm apart, diverging at an acute angle, in transverse section with a layer of seven large, thick-walled cortical cells surrounding the medulla of smaller cells; ventral flagelliform branches numerous. Rhizoids colorless. Line of leaf insertion oblique, the leaves incubous. Leaves distant to subimbricate, erect-spreading, asymmetric, ovate, 0.6–0.9 mm long, 0.25–0.4 mm wide below, unequally bifid to one-third or one-half of their length; segments unequal, triangular, acute to acuminate, the ventral segment two to four times longer than the dorsal; leaf-cells below the segments 12–15 μ wide, the walls strongly thickened, the lumina rounded, cells in the lower part of the leaf larger, forming a vitta of thin-walled cells, the cuticle smooth. Underleaves distant, squarrose, broadly elliptic, divided to the middle into three broad, rounded lobes. Plants dioicous. Male branches short, the monandrous bracts in four pairs. Female bracts and bracteoles in three series, the innermost series largest, ovate, 1.2×0.5 mm, bifid to one-half of their length, the segments attenuate, entire, the sinus narrow, the margins entire or with a ciliate tooth on one or both sides and scattered slime papillae below. Perianth fusiform, to 3 mm long, terete below, with three rounded keels above, the mouth plicate, contracted, and laciniate with to 12 slender laciniae. Capsule stalk of an outer layer of eight large cells surrounding about 20 smaller cells: elaters 15–18 μ long, the spores mostly 12 μ, minutely verruculose. Pl. 38.[3] Fig. 1, a–j.

Habitat: Over soil and on trunks of trees.

PATAGONIA: Halt Bay, *Cunningham 186* (NY); Chiloe I., *Skottsberg* [1908], the type of *M. chiloense* (G).

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[3] Beginning here, figures will be cited with plate numbers. Plates No. 1–37 [unnumbered] are in Part I.

It has also been reported from the following localities: Patagonia (Kühnemann, 1949; Stephani, 1900b, 1911) and Tierra del Fuego (Massalongo, 1885; Stephani, 1900b).

The original material of this species was collected in South Island, New Zealand, at Dusky Sound by Menzies (B). The species has an Antarctic distribution and occurs in the Auckland Islands, New Zealand, and Tasmania in addition to the localities in South America.

2. Acromastigum laetevirens (Sande LaCosta) Evans, Ann. Bryol. Suppl. **3:** 94. 1934.

Mastigobryum laetevirens Sande LaCosta in Stephani, Hedwigia **25:** 133. *pl. 4. f. 4–6.* 1886.

Mastigobryum laetevirens Ångström in Stephani, Spec. Hep. **3:** 540. 1909. Icon. Hep., *Mastigobryum No. 487.*

Plants in depressed dingy green mats; stems to 10 mm long, with leaves 0.3 mm broad, the branching dichotomies 2.5–3 mm apart, the branches in transverse section with seven large thick-walled cortical cells surrounding the medulla of smaller cells. Rhizoids colorless, on the bases of the underleaves. Line of leaf insertion oblique, the leaves incubous. Leaves imbricate, erect-spreading, asymmetric, rectangular to ovate, deflexed above, 0.5–0.6 mm long, 0.25–0.3 mm wide at the base, the apex equally or unequally bifid; dorsal segment triangular-acute, eight to ten cells wide at the base, the ventral segment triangular but usually four to six cells wide at the base; cells of the lamina below the segments averaging 20 μ, the walls thin, the trigones small, the cells near the base larger, scarcely forming a vitta, the cuticle minutely verruculose or striolate-verruculose. Underleaves approximate to broadly orbicular, subimbricate, appressed, 0.2–0.25 mm long, 0.25–0.3 mm wide, divided to the middle into three broad, rounded to truncate lobes. Other parts not seen. Pl. 38. Fig. 2, a–e.

Habitat: Not given.

CHILE: Corral, *K. Krause* (type G).

This species has also been reported from Hale Harbor (Stephani, 1911) and from Valdivia (Herzog, 1960).

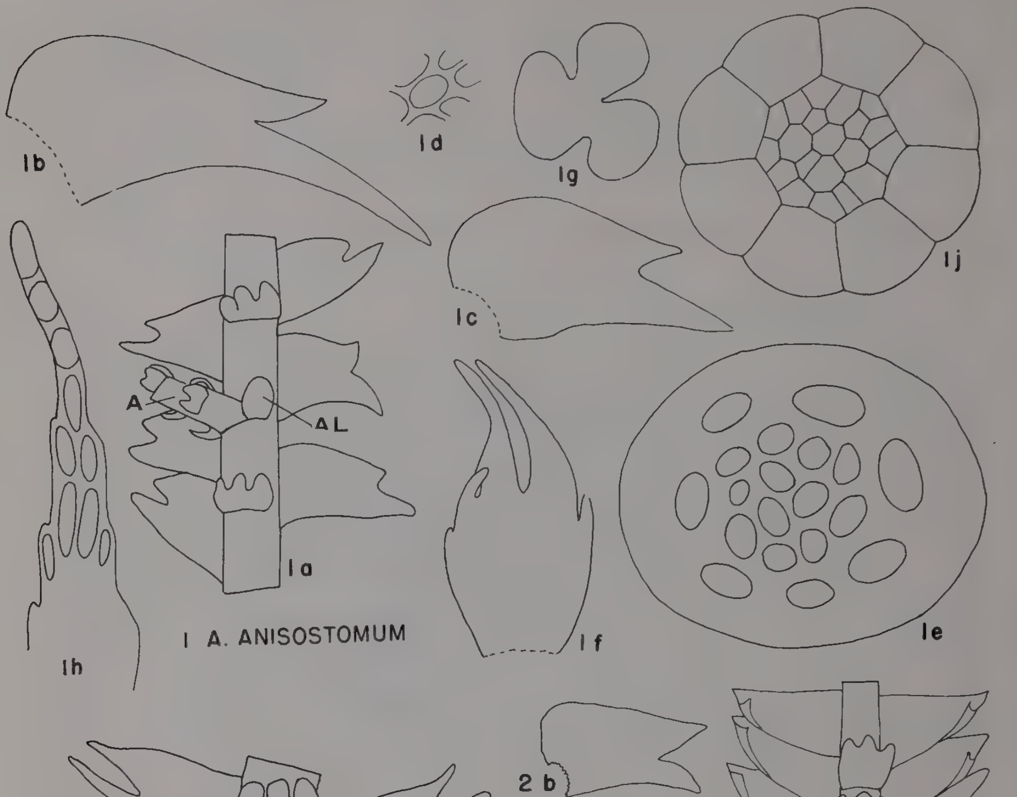
3. Acromastigum cunninghamii (Stephani) Evans, Ann. Bryol. Suppl. **3:** 106. *f. 25.* 1934.

Bazzania cunninghamii Stephani, Hedwigia **32:** 205. 1893.

Mastigobryum cunninghamii Stephani, Spec. Hep. **3:** 540. 1909; Icon. Hep., *Mastigobryum No. 485.*

Plants pale, yellowish-green; stems 1–2 cm long, with leaves to 0.4 mm broad, the leafy dichotomies 2–6 cm apart; ventral flagelliform branches few; branches in transverse section with seven large, thick-walled cortical cells surrounding the medulla of smaller cells. Rhizoids colorless, on the underleaves. Line of leaf insertion oblique, the leaves incubous. Leaves imbricate, widely spreading, asymmetric, ovate to rectangular, 0.4–0.5 mm long, 0.15–0.25 mm wide at the base, unequally bifid for one-third to one-half of their length; dorsal segment triangular, four to six cells wide at the base, the ventral segment slightly longer, two cells wide nearly to the tip; cells of the lamina below the dorsal segment averaging 16–20 $\mu \times 18$ μ, the walls more or less uniformly thickened, the lumina angular-rounded, a vitta of larger cells present in the ventral half of the lamina, the cuticle smooth. Underleaves contiguous to subimbricate, appressed, orbicular-quadrate, divided to the middle or beyond into three similar ligulate to ovate, truncate segments. Sexual branches and sporophytes not seen. Pl. 38. Fig. 3, a–c.

Habitat: Not given.


1 b
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2 A. LAETEVIRENS
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3 A. CUNNINGHAMII

Plate 38

FIG. 1. *Acromastigum anisostomum.* 1 a. Leafy stem, ventral view, × 40; A, flagelliform branch of the Acromastigum type; AL, half-underleaf with this branch. 1 b. c. Leaves, × 50. 1 d. Leaf cell, × 350. 1 e. Transverse section of a leafy branch showing the seven cortical cells, × 225. 1 f. Female bract of the innermost series, × 40. 1 g. Transverse section of the

PATAGONIA: Hay Harbor, *Cunningham 147* (type K, isotype NY); Halt Bay, *Cunningham 96* (NY).

Other reports from Patagonia include those cited by Herzog (1954, 1960), Kühnemann (1949), and Stephani (1911).

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Lindenberg, J. B. G. & Gottsche, C. M. Species Hepaticarum, *Mastigobryum.* i–xii, 1–118. pl. 1–21. 1851.

Hodgson, E. Amy. New Zealand Hepaticae (Liverworts)-VIII. A review of the New Zealand species of the genera *Bazzania* and *Acromastigum*. Trans. Roy. Soc. New Zealand **82:** 7–24. *fig. 1–16.* 1954.

Paracromastigum Fulford & J. Taylor, Brittonia **13:** 336. 1961.

Lepidozia auctt. p.p.

Plants small, pale green, the tips sometimes reddish-brown; stems slender, erect, tending to be radial, irregularly branched, the lateral branches leafy, of the *Frullania* type with the ovate half-leaf on the dorsal side of the stem, the ventral branches leafy, of the *Acromastigum* type, with the ovate half-underleaf adjacent to the branch, or axillary-intercalary and flagelliform; stem in transverse section with a unistratose cortical layer of about 12 (13) cells slightly larger than those of the medulla. Line of leaf insertion transverse. Leaves and underleaves ovate-rectangular to subquadrate, the leaves bifid (rarely trifid) to one-half or one-third of their length, occasionally toothed on one or both sides. Underleaves trifid (sometimes bifid) to one-third of their length. Male and female inflorescences and sporophyte not seen.

Type species: *Lepidozia subsimplex* Stephani.

Paracromastigum subsimplex (Stephani) Fulford & J. Tayor, Brittonia **13:** 336. *f. 52–58.* 1961.

Lepidozia subsimplex Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 66. *f. 24, r–s. 1911.* Icon. Hep., *Lepidozia No. 143.*

Plants small, pale green, the leaves and underleaves often tinged with reddish-brown, appearing to be denuded, in tufts or among other bryophytes; stems slender, suberect, tending to be radial, to 4 cm or more long, with leaves to 0.3 mm broad, sparingly irregularly branched, the lateral branches long, leafy, the ventral branches long, leafy, of the *Acromastigum* type or ventral intercalary. Line of leaf insertion transverse. Stem leaves ovate-rectangular to subquadrate, with convex sides, occasionally with a short tooth on one or both margins, bifid (occasionally trifid) to one-half or one-third their length; segments

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perianth above the middle, × 40. 1 h. Segment of the perianth mouth, × 225. 1 j. Transverse section of the sporophyte stalk, × 225.

FIG. 2. *A. laetevirens.* 2 a. Leafy stem, ventral view, × 40. 2 b. Leaf, × 40. 2 c. Leaf cell from the base of the segment, × 350. 2 d. Underleaf, × 80. 2 e. Transverse section of the leafy branch, × 350.

FIG. 3. *A. cunninghamii.* 3 a. Leafy stem, ventral view, × 50. 3 b. Leaf cell from the base of a segment, × 350. 3 c. Transverse section of the leafy branch, × 225.

Figures 1 and 3 after Evans, 1934; fig. 2 from the type.

triangular from a 4–6-celled base, ending in a tip of one or two cells; leaf-cells at the base of the segments 40–50×27 μ, the walls thickened, the cuticle smooth. Underleaves scarcely smaller than the leaves, trifid (rarely bifid) to one-third of their length. Male and female inflorescences and sporophyte not seen. Pl. 39. Fig. 1, a–f.

Habitat: Swampy ground.

PATAGONIA—TIERRA DEL FUEGO: Guaitecas I.: Melinca, *Halle* [1908] (type G-376).

Bonneria Fulford & J. Taylor, Brittonia **13:** 334. 1961.

Lepidozia auctt. p.p.

Plants of small to medium size, brownish-green; stems irregularly branched, the lateral branches of one side of the stem of the *Frullania* type, with a dorsal lanceolate half-leaf, and on the other side of the *Microlepidozia* type, with a ventral unequally bifid half-leaf; ventral branches leafy, of the *Acromastigum* type, with a lanceolate half-underleaf adjacent to the branch, or axillary intercalary and long, leafy or flagelliform, or short sexual; stems in transverse section of a unistratose layer of 12 large, thin-walled cells similar to those of the medulla. Rhizoids in tufts on the scale-leaves of the flagelliform branches. Line of leaf insertion transverse to slightly oblique, the leaves tending to be succubous. Leaves spreading, cuneate, unequally bifid or trifid to one-third of their length, the leaf-segments triangular, acute, the leaf-cells quadrate to rectangular in outline. Underleaves similar to the leaves, smaller. Plants dioicous (?). Male inflorescence on a short ventral sexual branch, the bracts and bracteoles in 25 or more series. Female inflorescence and sporophyte not seen.

Type species: *Lepidozia granatensis* Gottsche.

This monotypic genus is unique in that three types of terminal branching, the *Frullania*, *Microlepidozia*, and *Acromastigum* types, occur on one stem along with the ventral-intercalary branches in the axils of the underleaves. The latter may be leafy, flagelliform, or sexual. This situation represents an extremely primitive condition not known in any other genus of Hepaticae. Although the *Acromastigum* type of branching also occurs in both *Acromastigum* and *Paracromastigum*, these latter genera do not possess branches of the *Microlepidozia* type.

1. **Bonneria granatensis** (Gottsche) Fulford & J. Taylor, Brittonia **13:** 334. *f. 42–51.* 1961.

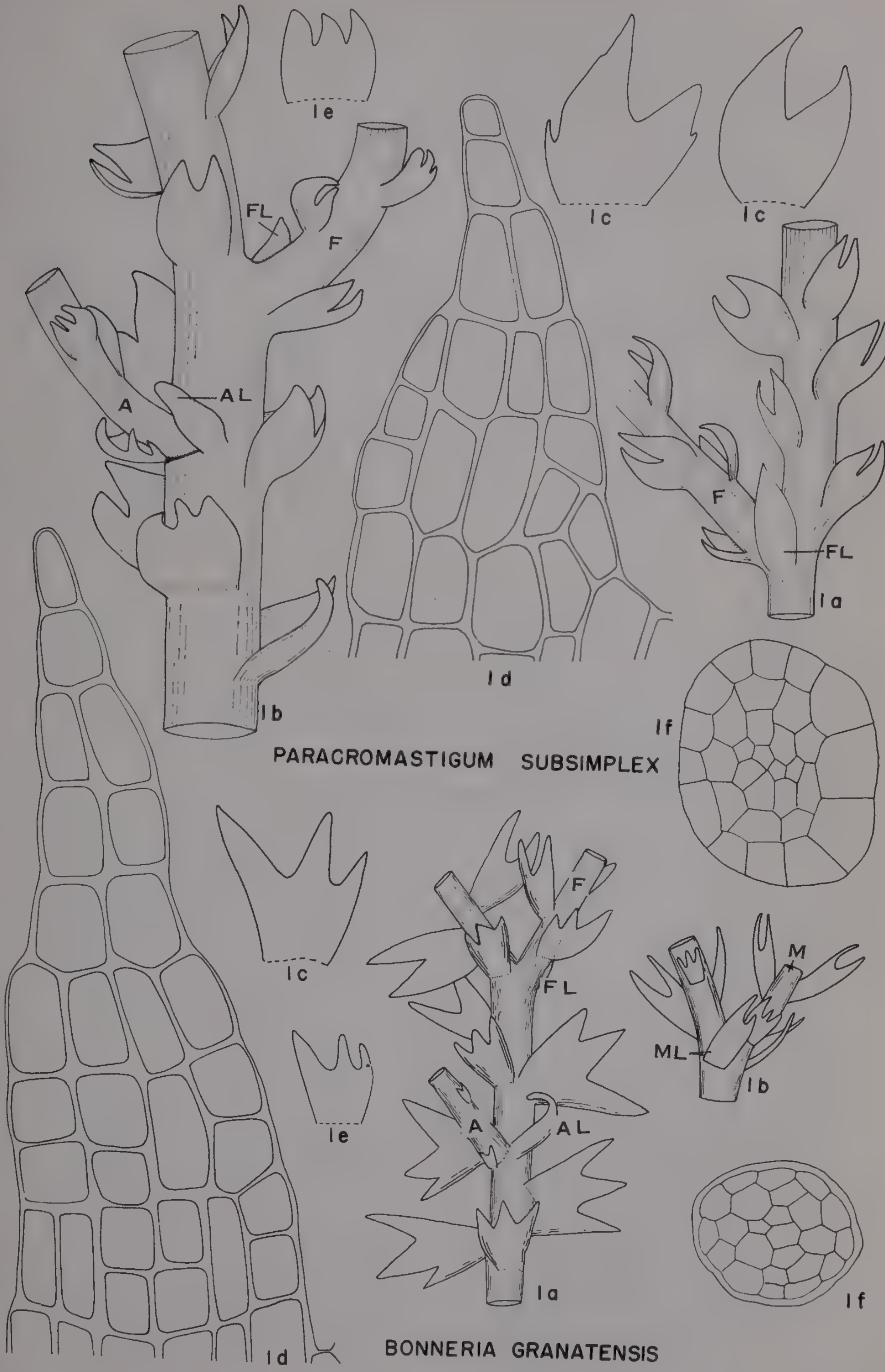
Lepidozia granatensis Gottsche, Ann. Sci. Nat. V. **1:** 139. 1864.

Plate 39

Paracromastigum subsimplex. 1 a. Stem, dorsal view, × 40; F, branch of the *Frullania* type, FL, half-leaf with this branch. 1 b. Stem, ventral view, × 45; A, branch of the *Acromastigum* type; AL, the half-underleaf with this branch; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch. 1 c. Leaves, × 57. 1 d. Segment of a leaf, × 375. 1 e. Underleaf, × 57. 1 f. Transverse section of the stem, × 185.

Bonneria granatensis. 1 a. Stem, ventral view, × 40; A, branch of the *Acromastigum* type; AL, half-underleaf with this branch; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch. 1 b. Another stem, ventral view, × 40; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 1 c. Leaf, × 57. 1 d. Segment of a leaf, × 375. 1 e. Underleaf, × 57. 1 f. Transverse section of the stem, × 185.

Drawings after Fulford and J. Taylor, 1959.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PARACROMASTIGUM SUBSIMPLEX

BONNERIA GRANATENSIS

Plate 39

Plants of small to medium size, green, pigmented with brown, in tufts or mats or among other bryophytes; stems ascending to erect, at least 2 cm long, irregularly branched, the lateral branches leafy, diverging at a wide angle, the ventral branches leafy or flagelliform, of the *Acromastigum* and ventral intercalary types; stem in transverse section with a unistratose cortical layer of 12 large cells similar to those of the medulla. Line of leaf insertion transverse to slightly oblique, the leaves succubous. Leaves distant, spreading, cuneate, the lateral margins nearly straight, entire, the base nine rows of cells wide, bifid or trifid to about half of their length; segments equal or unequal, divergent, triangular from a 4–6-celled base, ending in an acute tip of one or two cells; leaf-cells 36–60 × 15–23 μ, the walls thickened, the cuticle verruculose. Underleaves large, about half as large as the leaves, mostly cuneate, trifid (rarely bifid) to one-third of their length, the segments divergent. Branch leaves and underleaves a little smaller, more often only bifid. Male inflorescence on a short ventral sexual branch, the bracts and bracteoles in 25 or more series, imbricate, the bracts concave, bifid, often with a tooth on the lateral margins, the bracteoles smaller, plane. Female inflorescence and sporophyte not seen. Pl. 39. Fig. 1, a–f.

Habitat: Not known.

COLOMBIA: Bogotá, "In desertis Páramo de San Fortunato," 2900 m, *Lindig* (type G).

The species is also reported from Costa Rica (Stephani, 1893) and Colombia (Herzog, 1934a).

Lepidozia (Dumortier) Dumortier, Recueil Obs. Jungerm. 9. 1835.[4]

Pleuroschisma sect. *Lepidozia* Dumortier, Syll. Jungerm. 69. 1831.
Mastigophora C. G. Nees, Nat. Eur. Leberm. **1:** 95, 101. 1833. Non Nees, Nat. Eur. Leberm. **3:** 85. 1838.
Herpetium sect. *Lepidozia* C. G. Nees, Nat. Eur. Leberm. **3:** 85. 1838.
Lepidozia subg. *Eulepidozia* Spruce, Jour. Bot. London **14:** 164. 1876.
Lepidozia subg. *Ptilolepidozia* Spruce, Jour. Bot. London **14:** 164. 1876.

Plants in whitish, yellow-green, greenish-brown, or brown mats or tufts, often pendulous or among other bryophytes; stems filiform to robust, 0.5–10 cm long, pinnate or bi-tripinnate, the lateral branches usually of limited growth, of the *Frullania* type with the dorsal half-leaf ovate, bifid, often becoming flagelliform in the outer part, the ventral branches axillary, intercalary, flagelliform, occasionally leafy, or very short, sexual. Stem in transverse section rounded, usually pigmented with brown, little differentiated. Rhizoids colorless, the tips enlarged or variously branched, from the scales of flagelliform branch tips, more rarely from the bases of the underleaves. Line of leaf insertion straight to slightly curved, subtransverse, oblique or almost longitudinal. Leaves incubous, alternate, symmetric or asymmetric, quadrate, rectangular, broadly cuneate or ovate-truncate, the dorsal margin convex from a straight to cordate base, the margins of the lamina entire or toothed, incised or ciliate, quadrifid (in some species with five or six segments), the segments triangular; leaf-cells quadrate-hexagonal, the walls uniformly thickened, the trigones when present minute. Underleaves transverse, nearly as large as the leaves to much smaller, the segments triangular to uniseriate, the margins entire, incised, toothed, or ciliate. Branch leaves and underleaves larger or smaller. Plants dioicous, a few species monoicous, the sexual branches short, ventral, axillary-intercalary. Male branches catkin-like (rarely becoming intercalary on a leafy stem), the bracteoles plane, the bracts concave, 2–5-parted above, diandrous (?); antheridia large, spherical, the stalk short, one or two cells thick. Female branches occasional, the bracts and bracteoles in three or four series, different from the leaves, orbicular-ovate, divided above. Perianth to 6 cm long, cylindric to fusiform, of several layers of cells below, one-layered above, the mouth contracted, crenulate to long-ciliate. Shoot/sporophyte relationship a shoot-calyptra. Sporophyte stalk, the seta, with a layer of 8–16 large cells surrounding 12 to 45 similar or smaller cells; capsule spherical, with a 3- or 4-layered wall, the outermost layer with brown knot-like thickenings along the radial walls, the innermost layer with brown bands across the inner tangential wall; spores small, brown; elaters long, slender, bispiral. Sporeling of the *Nardia* type.

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[4] This revision has followed in a large part the work of Dr. J. Taylor, 1960.

Type species: *Jungermannia reptans* L.

This large genus is most abundant in the mountain forests of tropical and subtropical regions, with a few species extending northward into the Northern Hemisphere, or southward from the subtropics as in *Bazzania*. A few species have an Antarctic distribution.

Unlike *Bazzania*, this genus does not consist of obvious, well-marked groups or sections, although differentiation has progressed along certain well-defined lines. There is a high degree of variability among the plants of some species and even between male and female plants of some species, so that limits of certain taxa are arbitrary.

Key to the Species

1. Plants of tropical, subtropical, and warm temperate areas.
  2. Plants very slender, filiform, appearing denuded; leaves scale-like.
    3. Stems irregularly branched, the branches very long, often dichotomous. 2. *L. subdichotoma*.
    3. Stems pinnately branched, the branches shorter, of limited growth.
      4. Lateral branches mostly simple; leaves plane or nearly so.
        5. Leaves spreading, cuneate, the segments widely spreading; plants brown. 1. *L. patens*.
        5. Leaves spreading, the segments tending to be connivent; plants brownish-green. 4. *L. portoricensis*.
      4. Lateral branches usually with several (often tufted) secondary branches; stem leaves strongly concave, the segments incurved, touching the stem; plants brownish. 3. *L. incurvata*.
  2. Plants small to large; leaves larger, not scale-like; stems regularly pinnate to bi- or tripinnate.
    3. Plants of small to medium size; stems with leaves less than 0.8 mm broad.
      4. Leaves very obliquely inserted, the line of attachment appearing to be nearly longitudinal.
        5. Leaf segments long, the cells mostly 30–36 μ, quadrate, thin-walled. 5. *L. reptans*.
        5. Leaf segments very short, widely divergent; leaves divided to one-fifth of their length; leaf cells $14–19 \times 14$ μ, the walls thickened; plants turgid, whitish. 6. *L. aequiloba*.
      4. Leave less obliquely inserted, often subtransverse.
        5. Leaves conspicuously rectangular; segments long, straight, the cells 30–36 μ, thin-walled. 5. *L. reptans*.
        5. Leaves not conspicuously rectangular, either cuneate, subquadrate or truncate-ovate.
          6. Leaves cuneate, the segments widely divergent, plane or incurved.
            7. Plants green to whitish; leaves usually widely spreading even when dry; leaf segments at least half the length of the leaf. 7. *L. squarrosa*.
            7. Plants greenish to brownish; leaves appressed when dry; leaf-segments plane to incurved, long-triangular.
              8. Bases of the leaf-segments mostly four to six cells wide.

9. Margins of the lamina of the leaves and underleaves with one or two teeth, the dorsal base cordate. 9. *L. lindigiana.*

9. Margins of the lamina of leaves and underleaves without teeth, or with a 1-celled tooth on the underleaves; dorsal base of the leaf straight or nearly so. 8. *L. caespitosa.*

8. Bases of the leaf segments mostly six to eight cells wide. 10. *L. jamaicensis.*

6. Leaves subquadrate or truncate-ovate.

7. Stem leaves very strongly concave to cucullate, the apices touching the stem.

8. Dorsal margin of the leaf strongly convex and extending across the stem.

9. Dorsal base of the leaf cordate to auriculate; margins of the leaves and underleaves with one to several teeth. 18. *L. macrocolea.*

9. Dorsal base of the leaf straight; margins of the leaves and underleaves essentially without teeth, (occasionally with a tooth on the underleaf); leaves very obliquely quadrifid. 20. *L. peruviensis.*

8. Dorsal margin of the leaf slightly convex from a straight base, the margins of the leaves and underleaves without teeth. 3. *L. incurvata.*

7. Leaves concave, never cucullate, the apices more or less erect or spreading, or if incurved, not touching the stem.

8. Many of the leaves and underleaves with five or six segments and supplementary teeth and cilia, the margins of the lamina always toothed. 19. *L. armata.*

8. Leaves and underleaves quadrifid.

9. Margins of the lamina of the underleaves usually with a tooth on either side. 15. *L. münchiana.*

9. Margins of the leaves and underleaves without cilia or teeth.

10. Plants tiny, leaf segments often connivent; segments of the underleaves uniseriate. 4. *L. portoricensis.*

10. Plants larger, the leaf segments ascending to spreading; underleaf segments triangular from a 2–4-celled base. 11. *L. brasiliensis.*

3. Plants of medium to large size; stem with leaves, 1.0 mm or more broad.

4. Margins of the leaves and underleaves essentially without teeth (an occasional tooth may sometimes be found on a leaf or underleaf).

5. Leaves strongly concave-cucullate to saccate, very obliquely truncate, the segments short, the tips often brownish. 20. *L. peruviensis.*

5. Leaves plane to concave, the segments spreading to ascendent.

6. Leaf segments less than one-fourth the length of the lamina, segments of the branch leaves often very short, blunt, with wide sinuses.

7. Segments and upper leaf margins without teeth. 12. *L. coilophylla.*

7. Segments with scattered, obscure or few-celled teeth. 12a. var. *apiculiloba.*

6. Leaf segments long-triangular.

7. Leaf segments with a broad, mostly 6– to 8-celled base and ending in an acute, 2-celled tip; underleaves squarrose, the triangular segments curved and parallel to the stem.

8. Mouth of the perianth subentire. 13. *L. cupressina.*

8. Mouth of the perianth ciliate, the cilia two to four cells long. 14. *L. pseudocupressina.*

7. Leaf segments ending in an accuminate, uniseriate, tip four to eight cells long.

8. Cell of the tip of the segment three or more times as long as wide. 17. *L. inaequalis.*

8. Cell at the tip of the segment at most twice as long as wide. 16. *L. wallisiana.*

4. Margins of the lamina of the leaves and/or underleaves (at least of the branches), with few to many teeth.

5. Stem leaves plane to concave, never saccate.

6. Leaves and underleaves very often with five or six segments, often with many supplementary teeth and cilia.

7. Segments of the leaves and underleaves regularly long-ciliate, with the cilia in three or four opposite rows. 24. *L. pinnaticruris.*

7. Segments of the leaves and underleaves if ciliate, with the cilia fewer and irregularly arranged along the margins.
8. Stem leaves concave, the dorsal base auriculate.
9. Cells of the segment-tips 36 μ or more long. 23. *L. andicola.*
9. Cells of the segment-tips 18 μ long. 22. *L. auriculata.*
8. Stem leaves concave, the dorsal base cordate, often with an appendage or teeth.
9. Segments of the leaf and underleaf with frequent marginal teeth and cilia; underleaves variously incised. 19. *L. armata.*
9. Segments of the leaf and underleaf essentially without teeth; ventral margin of the leaves convex and with one to several teeth. 18. *L. macrocolea.*
6. Leaves and underleaves with four segments, teeth and cilia only on the margins of the lamina.
7. Margins of the segments conspicuously uneven, undulate. 30. *L. alstoni.*
7. Margins of the segments straight, never undulate.
8. Margins of the leaf lamina with or without a tooth; underleaves with a tooth; underleaves with a conspicuous tooth on either side of the lamina near the base; the segments long-tapering from a 6–8-celled base, the uniseriate tip two or three cells long. 15. *L. münchiana.*
8. Margins of the leaf lamina (more often of the branch leaves), with one to several teeth; underleaf segments mostly from a 4-celled base, tapering to a uniseriate tip seven to ten cells long. 16. *L. wallisiana.*
5. Stem leaves concave-cucullate to saccate, the dorsal margin long, strongly arched across the stem, the ventral margin short, only to one-fourth as long or less.
6. Ventral margins of the leaves and the margins of the underleaves of the stems and branches with one to three short obscure teeth; dorsal leaf base straight or slightly rounded. 21. *L. dendritica.*
6. Margins of the stem leaves and underleaves with several teeth; margins of the branch leaves and underleaves with many teeth and cilia. Dorsal leaf base usually auriculate or appendiculate.
7. Cells of the segment-tips 18 μ long. 22. *L. auriculata.*
7. Cells of the segment-tips to 36 μ long. 23. *L. andicola.*
1. Plants of southern South America, i.e., Patagonia and Tierra del Fuego.
2. Plants large; stems with leaves to 2 mm or more broad; leaves to 1.85 mm broad at the base, the segments to 20 cells at the base; lamina of the leaves and underleaves with large teeth or spines near the base. 25. *L. chiloensis.*
2. Plants smaller; stems with leaves only 1 mm or less broad.
3. Margins of the leaves and underleaves without teeth.
4. Leaf segments in conspicuous pairs, incurved, leaf-cells large, usually 18–27 × 18–22 μ at the base of a segment; plants often brown. 28. *L. fuegiensis.*
4. Leaf segments not conspicuously in pairs, four to six cells broad at the base; leaf-cells at the base of the segment 16–18 × 18 μ; cuticle coarsely papillose. 29. *L. laevifolia.*
3. Margins of the lamina of the leaves and/or underleaves with one to several teeth or cilia.
4. Plants brownish; leaves and underleaves broader than long, the lamina of the leaves with one or more teeth, the lamina of the underleaves with bulging sides bearing several teeth; leaf cells 18–24 × 24 μ. 27. *L. cuspidata.*
4. Plants green to light brown; leaves and underleaves longer than broad; leaf-cells 10–18 × 18 μ.
5. Dorsal margin of the leaf with one sharp tooth; underleaf lamina with at least one large tooth at either base. 26. *L. chordulifera.*
5. Dorsal margin of the leaf denticulate, and short-ciliate, or with one–several teeth near the base; underleaf lamina usually with a lateral tooth on either side. 25. *L. chiloensis.*

1. **Lepidozia patens** Lindenberg in G. L. & N. Syn. Hep. 202. 1845.

Lepidozia microphylla var. β Lindenberg in G. L. & N. Syn. Hep. 202. 1845.
Mastigophora patens Trevisan, Mem. Ist. Lomb. III. **4**: 416. 1877.

Lepidozia commutata Stephani, Hedwigia **27**: 293. 1888; Icon. Hep., *Lepidozia No. 26a, b.*

Lepidozia microphylla auctt. p.p. [American plants.] Non *L. microphylla* Lindenberg in G. L. & N. Syn. Hep. 202. 1845.

Plants very slender, in pale green to light brown tangled mats, or among other bryophytes; stems filiform, to 15 cm long, pinnate or bipinnate, the lateral branches very long, 1–4 mm apart, often becoming flagelliform, the ventral branches flagelliform, rarely leafy with a flagelliform tip. Line of leaf insertion transverse or nearly so. Stem-leaves distant, appressed or spreading, more or less quadrate to cuneate on robust plants, the margins without teeth, 0.2–0.3 mm or more long, 0.2 mm broad at the base, quadrifid to one-half of their length; segments divergent, triangular, four to six cells wide below, ending in a row of one to four or sometimes to six cells; leaf-cells quadrate, thick-walled, averaging 16–20 μ at the base of the segments, the cell lumina rounded, the cuticle smooth. Branch-leaves similar, but with longer segment tips. Underleaves distant, minute, averaging 0.15 mm long, 0.2 mm wide, quadrifid to the middle, the segments uniseriate or nearly so. Male branches frequent, from the stem or sometimes from near the tip of a flagelliform branch, the bracts and bracteoles in five or six series, the bracts larger than the leaves, imbricate, ovate, concave, bifid to one-third their length, the bracteoles smaller; antheridia in pairs, large, globose, short-stalked. Female branches frequent, the bracts and bracteoles in three to five series, the bracts of the inner series broadly ovate, quadrifid to the middle and with a few short teeth on the upper margins of the lamina. Perianths to 6 cm long, one-layered above, 2- or 3-layered in the middle and 3- or 4-layered at the base, the mouth contracted, undivided-undulate. Sporophyte not seen. Pl. 40. Fig. 1, a–c.

Habitat: On trunks and branches of trees and over soil.

CUBA: Oriente: Sierra Maestra, Loma Joaquin, *Ekman 14623* (S-PA); Sierra Maestra, Pico Turquino, 1700–1750 m, *Ekman 5269, 5270* (S-PA).

JAMAICA: Greenwich Woodland, 4000 ft, *Harris* (ABS-H); w of Mossman's Peak, 1650–1750 m, *Maxon 10204* (US); Newhaven Gap, 5500 ft, *Underwood 1031* (NY); s.l., Hb. Mitten (NY).

HAITI: Croix-des-Bonquets, 2100 m, *Ekman 7727* (S-PA); Mt. Cabaio, 1600 m, *Ekman 8002* (S-PA).

PUERTO RICO: El Yunque, *Evans 18, 88* (Y), *Pagán 1975* (NY); near El Yunque Tower, 3050 ft, *Pagán 551* (P); Luquillo Mts., *E. G. Britton 7718* (NY), *Br. Hioran* (NY), *Br. Hioran 396* (Y), *Steere 4271, 4274, 4275, 4312 p.p., 4389 p.p., 4429 p.p.* (Hb. Fulford); Sierra de Naguabo, *Johnson & Stevenson 1554 p.p., 1555 p.p.* (Y), *Shafer 3066, 3725b* (Y); s.l., *Sintenis 25,* the type of *L. commutata* (G).

ST. KITTS: s.l., *Breutel,* Hb. Mitten (type NY, isotype BM); Mt. Misery, *Britton & Cowell 512, 569* (NY), without collector (BR); s.l., without collector (G).

Plate 40

FIG. 1. *Lepidozia patens.* 1 a. Stem, ventral view, × 60. 1 b. Robust stem, dorsal view, × 33. 1 c. Stem leaf, × 40.

FIG. 2. *L. subdichotoma.* 2 a. Stem, ventral view, × 57. 2 b. Stem leaf, × 57. 2 c. Growth pattern of a plant.

FIG. 3. *L. incurvata.* 3 a. Stem, ventral view, × 35. 3 b. Stem leaf, × 57.

FIG. 4. *L. portoricensis.* 4 a. Stem, dorsal view, × 80. 4 b. Stem, ventral view, × 80. 4 c. Stem leaf, × 80. 4 d. Leaf segment with cells, × 350.

FIG. 5. *L. reptans.* 5 a. Stem, ventral view, × 45; F, branch of the *Frullania* type. 5 b. Stem leaf, × 57. 5 c. Leaf cell, × 350.

FIG. 6. *L. aequiloba.* 6 a. Stem, ventral view, × 45. 6 b. Stem leaf, × 57. 6 c. Stem underleaf, × 57.

Drawings after J. Taylor, 1960.

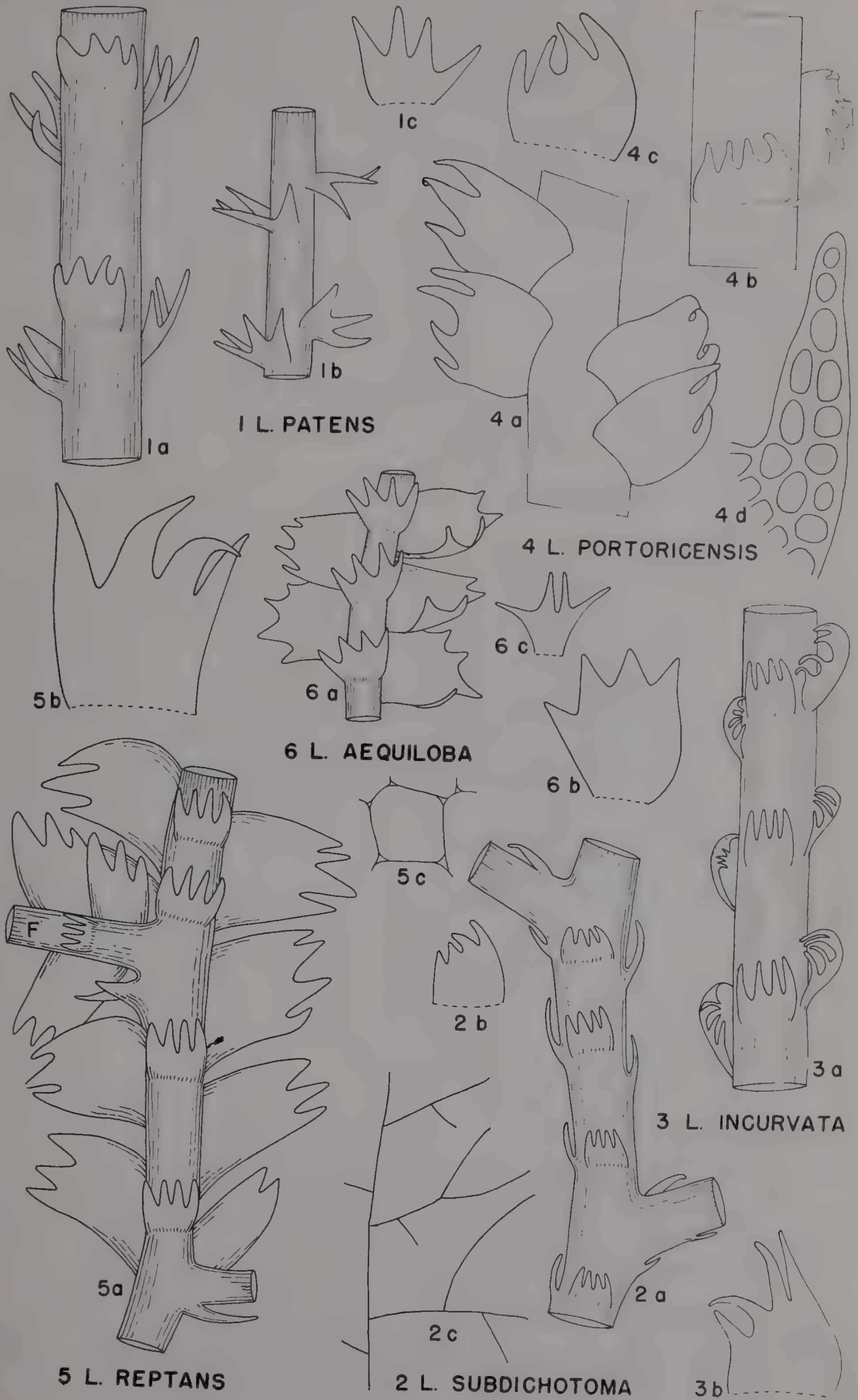
1a
1b
1c
1 L. PATENS
4a
4b
4c
4d
4 L. PORTORICENSIS
5b
6a
6b
6c
6 L. AEQUILOBA
3a
3b
3 L. INCURVATA
5a
5c
F
5 L. REPTANS
2a
2b
2c
2 L. SUBDICHOTOMA

Plate 40

GUADELOUPE: s.l., *Husnot, Pl. Antilles, no. 220* (as *L. microphylla*) (BR, G, YU); s.l., *l'Herminier,* as *L. commutata* (G); Sav-aun Ananas, 900–1300 m, *Duss 23* (NY); s.l., *Duss 163* (G); Bois de l'Ass de Pigne, *Duss 268* (NY); summit of Grand Marron, *Duss 1027* (NY); Soufrière, *Stiffer 23* (G); s.l., *l'Herminier, Gottsche & Rabenhorst, Hep. Eur., no. 565,* as *L. microphylla* α (BR, G); forêt de Baines Jaunes, *Le Gallo 225 p.p., 241 p.p., 246, 276* (Hb. Le Gallo); Galion, *Le Gallo 255 p.p.,* (Hb Le Gallo); Mt. Soufrière, *Madiana* (PH).

DOMINICA: Mt. Laudat, *Lloyd 107* (NY); Providence, 1800 ft, *Gregory* (BM); Morne Anglais, *Elliott 487f* (BM); Morne Trois Pitons, *Elliott 729c p.p.* (BM); Morne Diablotin, *Elliott 1007d p.p., 1074 p.p.* (BM); s.l., *Elliott 1065, 1090, 1616* (G); s.l., *Eggers 171* (G).

MARTINIQUE: Mt. Pelée, *Duss 591* (NY); s.l., *Duss* (G); Mt. Pelée, *Holler 4* (G); s.l., or collector (Hb. Montagne) (PC); s.l., *Perrottet* (PC).

GUATEMALA: Zacapa: slopes of Volcán Gemalos, *Steyermark 43291* (F).

COLOMBIA: Norte de Santander: Sarare, 2150–2250 m, *Cuatrecasas, Schultes & Smith 12448E* (US).

VENEZUELA: Estado Bolívar: Mt. Roraima, 2100–2600 m, *Steyermark 58926 p.p.* (F); Roraima, *Ule 630* (G).

Other reports of the species include Puerto Rico (Stephani, 1888; Pagán, 1939), St. Kitts, (Lindenberg & Gottsche, 1846), Guadeloupe, (Bescherelle, 1893), Martinique (Stephani, 1904), Mexico (G. L. & N., 1844–1847), Costa Rica (Herzog, 1938a), Colombia (Montagne, 1839b), and British Guiana (Stephani, 1901c).

2. **Lepidozia subdichotoma** Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 361. 1885.

Plants very slender, thread-like, appearing denuded, in intricate red-brown mats or among other bryophytes; stems pale green, becoming reddish-brown, filiform, to 5 cm or more long, with minute leaves and underleaves, creeping, suberect or pendulous, irregularly pinnately to bipinnately branched, often appearing subdichotomous, the lateral branches long, branched, of unlimited growth, ventral flagelliform branches frequent; stem in transverse section of thick-walled cells, those of the unistratose cortical layer larger than those of the medulla. Line of leaf insertion transverse or nearly so. Stem leaves distant, scale-like, appressed, to 0.25 mm long, more or less quadrate, quadrifid to one-third of their length, the segments subulate, at most two cells broad at the base, two or three cells long, the lamina obliquely truncate, without marginal teeth; leaf-cells below the segments averaging $14 \times 18\ \mu$, the walls thickened, the cell lumina rounded, the cuticle smooth. Underleaves narrower than the stem, plane, quadrifid to one-half of their length, the segments mostly uniseriate. Branch-leaves and underleaves often smaller. [Female bracts and bracteoles in three series, the bracts concave, divided in the upper part into three or four segments, the margins subdentate. Perianth fusiform, 3-keeled above, the mouth constricted, subentire. *Spruce,* 1885.] Male inflorescence and sporophyte not seen. Pl. 40. Fig. 2, a–c.

Habitat: Over soil in moist mountain forests.

ECUADOR: Andes Quitenses: Mt. Abitagua, *Spruce,* Hb. Jack (G-368); Canelos, *Spruce* (type MANCH-Kk 1490, isotype G-367); Azuay, s of El Pan, 2650–3290 m, *Steyermark 53373 p.p.* (F).

It has also been reported from Ecuador (Herzog, 1957a).

The species is to be recognized by its filiform, denuded appearance, the irregularly branched, red-brown stems and the small, appressed leaves with subulate segments.

3. **Lepidozia incurvata** Lindenberg in G. L. & N. Syn. Hep. 203. 1845.

Mastigophora microphylla Montagne & Nees in d'Orbigny, Voy. l'Merid.: **7^2:** 73. 1839.
Mastigophora trichodes Montagne in d'Orbigny, Voy. l'Merid. **7^2:** 73. 1839.

Mastigophora incurvata Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Lepidozia lechleri Stephani, Spec. Hep. **3:** 567. 1909; Icon. Hep., *Lepidozia No. 67.*
Lepidozia microphylla auctt. p.p. [American plants.]

Plants slender, coarse thread-like or larger, in intricate yellowish to olive-green or reddish-brown mats; stems to 6 cm long, with leaves to 0.5 mm broad, tripinnately branched, the lateral branches long, usually becoming attenuate-flagelliform, the secondary branches usually crowded, appearing tufted, the ventral flagelliform branches long. Leaf insertion oblique, the leaves incubous. Stem-leaves distant to approximate or imbricate, convex with the segment-tips incurved and tending to touch the stem, 0.2–0.4 mm long, 0.4 mm broad at the base, the dorsal margin of the lamina strongly arched and without teeth, unequally quadrifid from one-fifth to one-third of their length, the segments unequal, incurved, straight to connivent, triangular from a 2- to 5-celled base, the apex acute, of one or a row of several cells; leaf-cells quadrate to rectangular, 18–24 × 18 μ, the walls thickened, the lumina rounded, the cuticle smooth. The branch leaves often ascendent to spreading, smaller. Underleaves as wide as the stem or smaller, quadrate to one-half of their length, the segments uniseriate from a 2- or 3-celled base. Male and female inflorescences and sporophyte not seen. Pl. 40. Fig. 3, a, b.

Habitat: Moist banks and sandstone rock faces and on trunks of trees.

GUATEMALA: n of Sija, *Sharp 2260 p.p.* (TENN); between Chajul and Nebaj, *Sharp 5306 p.p.* (TENN).

COSTA RICA: La Palma, *Standley 16217 p.p.* (F); San Ramón, *Brenes 16206* (F); s of Cartago, 7238 ft, *Little 5630 p.p.* (Hb. E. Little); lagune du Barba et le Carrizal, *Pittier 6011* (BR).

COLOMBIA: Monte Quindio, *Humboldt,* Hb. Rom, ex Lehmann (type G-225); Norte del Santander: Sarara, 2150–2250 m, *Cuatrecasas, Schultes & Smith 12448aa, 12448H* (US); Huila-Cauca: Páramo de Las Papas, *Bischler 769 p.p., 816 p.p., 831 p.p.* (COL).

VENEZUELA: Bolívar: Ptari-tepuí, 2410 m, *Steyermark 59596, 59893 p.p.* (F).

PERU: Cuzco: La Convención, *Bues 1159* ♂ (NY); s.l., *Weddell,* type of *L. lechleri* (G); Carabaya, *Weddell* (PC); Talanara, *Lechler 3113* (G).

BOLIVIA: Unduavi, 10,000 ft, *Brooke 6861A* ♀ (NY); R. de la Reunión, *d'Orbigny 314* [as *M. microphylla*], Hb Montagne (PC); same locality, *d'Orbigny 315* [as *M. trichodes*], Hb Montagne (PC).

It has also been reported from Costa Rica (Stephani, 1893a, Herzog, 1938), Colombia (G. L. & N. 1845; Lindenberg & Gottsche, 1846; Gottsche, 1864) and Peru (Hampe, 1854, as *L. microphylla*).

4. **Lepidozia portoricensis** Fulford, sp. nov.

Caules parvissimi ad 2 cm longi, virides pallidi, bipinnati; folia oblique truncato-ovata, quadrifida, cellulis 18 × 18 μ vel minoribus, parietibus incrassatis, trigonibus distinctis; amphigastria parva, quadrata, quadrifida, segmentis uniseriatis.

Plants very small, in intricate yellowish to whitish-green patches or scattered among other bryophytes; stems to 2 cm long, with leaves 0.48 mm broad, bipinnately branched, the branches 2–3 mm apart, 2–3 mm long, often branched, becoming flagelliform at the tips, ventral flagelliform branches occasionally produced. Line of leaf insertion oblique. Stem and branch leaves obliquely truncate-ovate, to 0.26 mm long, 0.24 broad at base, the lamina with convex margins, entire, quadrifid to one-half of their length; segments triangular from a 2- or 3-celled base, mostly 5–6 cells long, the apex uniseriate by two or three cells; leaf-cells at the base of the segments quadrate, 18 μ or less, the walls thick, the lumina rounded, the cuticle smooth. Underleaves small, scarcely as broad as the stem, concave, quadrate and quadrifid to the middle, the segments uniseriate. Male and female inflorescences and sporophyte not seen. Pl. 40. Fig. 4, a–d.

Habitat: On trunks of trees.

PUERTO RICO: Sierra de Luquillo: El Toro, upper slopes, *Steere 4354* (NY, Hb. Fulford); Río Sabana Trail, El Toro Range, *Steere 6433* (type NY), *6434* (Hb. Fulford).

5. Lepidozia reptans (L.) Dumortier, Recueil Obs. Jungerm. 19. 1835.

Jungermannia reptans Linnaeus, Sp. Pl. 1133. 1753.
Pleuroschisma reptans Dumortier, Syll. Jungerm. 69. 1831.
Herpetium reptans C. G. Nees, Nat. Eur. Leberm. **3:** 31. 1838.
Lepidozia reptans var. *β australis* Gottsche, Mex. Leverm. 126. 1863. (non Nees)
Mastigophora reptans Trevisan, Ist. Lomb. Reudiconte **7:** 785. 1874.
Lepidozia liebmanniana Stephani, Spec. Hep. **3:** 574. 1909; Icon. Hep., *Lepidozia, No. 68/69.*
Lepidozia macropatens Herzog, Revue Bryol. Lichénol. **11:** 20. f. 2. 1938.

Plants small, in whitish to yellowish-green or dirty green mats or tufts, or scattered among other bryophytes; stems to 3 cm or more long, with leaves, 0.65 mm broad, prostrate to ascending, pinnate or bipinnate, the lateral branches frequent, short or becoming attenuate and very long flagelliform, ventral flagelliform branches not seen. Rhizoids from the scales of the tips of flagelliform branches. Line of leaf insertion oblique, the leaves incubous. Stem leaves approximate to imbricate, spreading, plane or becoming concave in the outer part, quadrate to longer than broad, to 0.54 mm long, 0.8–1.0 mm wide at the base, the dorsal base curved, the margins without teeth, quadrifid or often trifid to about one-third of their length; segments subequal, incurved or spreading, long triangular, from a 2- to 4-celled base, the apex acute and ending in one or two cells; leaf cells at the base of the segments 30–36 μ, quadrate-hexagonal, the walls thin, with tiny trigones, the lumina rounded, the cuticle smooth. Underleaves a little broader than the stem, concave, the segments erect, quadrifid to one-half their length, the segments triangular, from a 2- to 3-celled base and ending in a 1- or 2-celled tip. Branch leaves and underleaves often somewhat smaller. Plants monoicous. Male branches very short, the bracts in four to eight pairs, imbricate, concave, bilobed to one-third of their length; antheridia solitary, large, short-stalked. Female inflorescence on a short ventral branch, the bracts and bracteoles in three or four series, light green, the bracts broadly ovate, 4- or 6-dentate. Perianth whitish, cylindrical, fusiform, the mouth contracted, lobate and short-ciliate, and denticulate. Pl. 40. Fig. 5, a–c.

Habitat: On soil, stumps, logs, trees, and over sandstone rocks at higher elevations.

HAITI: Massif de la Pelle, Peconville, 1600 m, *Ekman 8002* (S-PA); Badeau, 2100 m, *Ekman 7717* (S-PA).

DOMINICA: s.l., *Eggers* (NY).

MEXICO: Chinantla: Cerro de Sempoaltepec, *Liebmann 152 p.p.,* the type of *L. liebmanniana* (G); above Río Frio, 10,500 ft, *Sharp 308* (TENN); Durango: w of El Salto, 8800 ft, *Sharp 1845* (TENN).

GUATEMALA: Volcán Tajumulco, San Marcos, 10,200 ft, *Sharp 5400 p.p.* (TENN). Quezaltenango: above Chiquilval, *Sharp,* soil bank, 7500 ft, *2024;* soil, 7200 ft, *2081;* stump, 8200 ft, *2136;* log, 8450 ft, *2143, 2144, 2161* (TENN); Cerro de Sija, 9900 ft, *Sharp 5065 p.p.* (TENN); Totonicapán, decayed log, 10,500 ft, *Sharp 2613* (TENN); Huehuetenango: below Nucá, 7400 ft, *Sharp 4934 p.p.* (TENN); Jalapa: near summit of Mt. Miramundo, 2000–2500 m, *Steyermark 32771 p.p.* (F); El Progreso: between Calera and summit of Volcán, *Steyermark 43057 p.p.* (F).

COSTA RICA: S. José: Cerro de las Veultas, 2700–3000 m, *Standley 43723* (Hb Herzog).
COLOMBIA: near Zipaquirá, 2600–2750 m, *Schultes & Bell 11472* ♀ (FH).
VENEZUELA: Miranda: Pico de Naiguatá, 2200–2765 m, *Steyermark 62953 p.p., 62954 p.p.* (F).

The species is widespread circumboreal in the Northern Hemisphere.

6. Lepidozia aequiloba Stephani, Spec. Hep. **6:** 319. 1922; Icon. Hep., *Lepidozia No. 57.*

Plants small, in pale green mats or among other bryophytes; stems slender, 2 cm or more long, pinnately branched, the branches short, rarely becoming flagelliform near the tips. Line of leaf insertion very oblique. Stem leaves approximate to imbricate, longer than broad, 0.6 mm broad at the base, quadrifid to approximately one-fifth of their length; segments nearly equal, short, divergent, the bases four or five cells broad, the apices acute, the sinuses broad, lunulate; lamina long, the margins entire with the dorsal base curved; leaf cells quadrate-rectangular, 14–19 $\mu \times 14$ μ, the walls thickened, the lumina rounded, the cuticle smooth. Underleaves little broader than the stem, cuneate, quadrifid to one-half their length, the segments widely divergent, narrowly triangular with uniseriate tips. Male and female inflorescences and sporophyte not seen. Pl. 40. Fig. 6, a–c.

Habitat: Not known.

VENEZUELA: Estado Bolívar: Ptari-tepuí, 2410 m, *Steyermark 59878 p.p.* (F); Caracas, *Fendler* (G).
BRAZIL: Caraça, *Wainio* (type G).

7. Lepidozia squarrosa Stephani, Spec. Hep. **3:** 573. 1909; Icon. Hep., *Lepidozia No. 79.*

Lepidozia durandii Stephani, Spec. Hep. **3:** 568. 1909; Icon. Hep., *Lepidozia No. 55.*
Lepidozia costaricensis Stephani, Spec. Hep. **3:** 573. 1909; Icon. Hep., *Lepidozia No. 52.*

Plants small, in loose whitish to yellowish-green mats, or scattered among other bryophytes; stems to 6 cm or more long, distantly pinnate or occasionally bipinnate, the branches short often becoming flagelliform in the upper part, ventral flagelliform branches scarce. Leaf insertion oblique. Stem leaves distant, squarrose spreading, cuneate, averaging 0.3 mm long, 0.2 mm broad at the base, quadrifid to one-half their length; segments equal or unequal, widely spreading, triangular from a 3- to 6-celled base, ending in a one-, rarely 2-celled apex; dorsal base of the lamina cordate, entire or occasionally with a one-celled tooth; leaf cells at the base of a segment averaging $18\text{–}27 \times 18$ μ, the walls thickened, the trigones small, the lumina rounded, the cuticle smooth. Underleaves as broad as the stem, squarrose spreading, quadrifid to one-half their length, the segments narrow, two cells broad at the base and ending in a uniseriate row of two or three cells, the sinuses broad, lunulate. Male and female inflorescences and sporophyte not seen. Pl. 41. Fig. 7, a, b.

Habitat: On tree trunks and over bryophytes on rocks.

COSTA RICA: without locality, *Tonduz 2945* (type G); without locality, *Pittier 2945 p.p.*, the type of *L. costaricensis* (G); summit of Volcán de Poas, 2644 m, *Pittier 2944*, type of *L. durandii* (G-11252); without locality, *Tonduz, Flora Costaricensis no. 2947*, as *L. durandii* (G-11253). San José: La Palma, San Ramón, *Brenes 19020* (F); Colinas de San Pedro de San Ramón, *Brenes 19133* (F); Cerro de la Carpintera, *Little 5567* (Hb Little); Sierra de Talamanca, 7238 ft, s of Cartago, *Little 5618* (Hb Little); s of El Empalma, *Little 5631 p.p., 5633* (Hb Little).

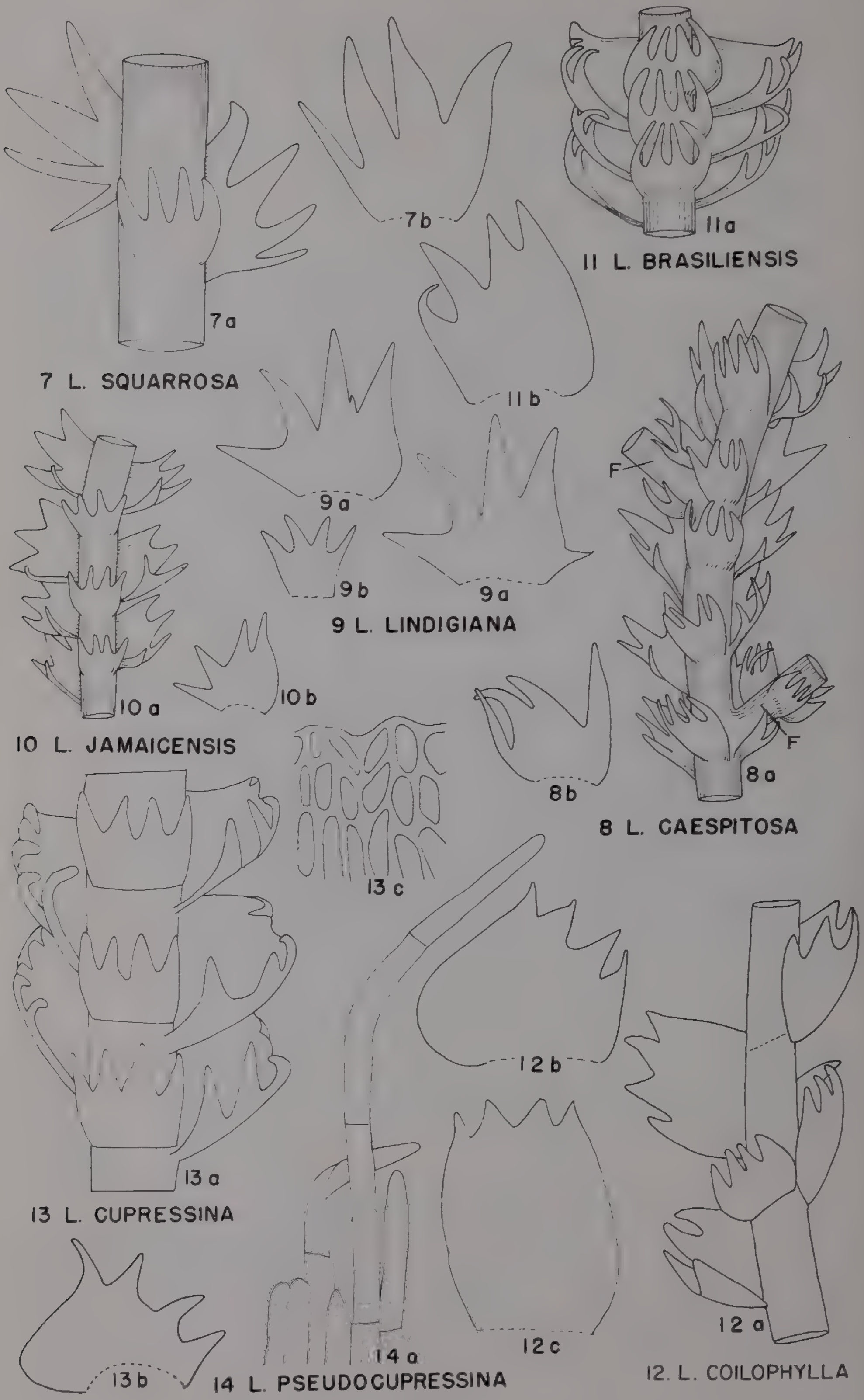
7b
11a
11 L. BRASILIENSIS
7a
7 L. SQUARROSA
11 b
F
9 a
9 b
9 a
9 L. LINDIGIANA
10 a
10 b
10 L. JAMAICENSIS
8b
F
8 a
8 L. CAESPITOSA
13 c
12 b
13 a
13 L. CUPRESSINA
12 a
14 a
12 c
13 b
14 L. PSEUDOCUPRESSINA
12. L. COILOPHYLLA

Plate 41

8. Lepidozia caespitosa Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 362. 1885.

Lepidozia obcuneata Stephani, Spec. Hep. **6:** 336. 1922; Icon. Hep., *Lepidozia No. 73.*
Lepidozia subtilis Stephani, Spec. Hep. **6:** 342. 1922; Icon. Hep., *Lepidozia No. 34.*

Plants very slender, small, in yellowish, dark green or brownish mats, or scattered among other bryophytes; stems to 6 cm or more long, with leaves 0.64–0.8 mm wide, distantly pinnate to bipinnate, the branches often becoming attenuate flagelliform in the outer part, ventral flagelliform branches occasional. Rhizoids from the scales of the flagelliform branches. Line of leaf insertion oblique. Stem leaves distant to imbricate, appressed when dry, spreading when moist, cuneate, the dorsal base curved, quadrifid to one-half of their length; segments spreading, narrow, unequal, triangular from a 4– 6-celled base and ending in a 2– 3-celled tip; leaf-cells rectangular, averaging 27 × 18 μ, the walls thickened, the lumina rounded, the cuticle verruculose. Underleaves little broader than the stem, squarrose-spreading, quadrifid to two-thirds of their length, the triangular segments two cells broad at the base, the uniseriate tip of two to four cells, the lamina often with a marginal tooth near the base. Sexual branches and sporophytes not seen. Pl. 41. Fig. 8, a, b.

Habitat: On soil, rock faces, and trunks of trees.

GUATEMALA: El Progreso: near Volcán Santa Louisa, *Steyermark 43527 p.p.* (F).

HONDURAS: near El Achote, *Yuncker 6615 p.p.* (DPU); Morazán, 1600–1800 m, *Standley 8023 p.p.* (F).

SALVADOR: above Hacienda Los Planos, *Carlson 961b* (Hb Carlson).

COSTA RICA: Cerro Central de Zurqui, *Dodge 6074* p.p. (?) (NY); s.l., *Endres,* ex Hb Kew (G-144).

COLOMBIA: Cauca: Macizo Colombiano, 3200–3510 m, *Bischler 889 p.p., 891 p.p.* (COL); Meta: Cordillera La Macarena, 1700 m, *Schultes* 11215 (FH); Pico Renjifo, Caño Tiranas, 1700 m, *Schultes 11215* (FH); Huila-Cauca: Macizo Colombiano, Páramo de Las Papas, 3200–3510 m, *Bischler 889 p.p., 891 p.p.* (COL); Norte de Santander: Altó de Santa Inés 2150–2250 m, *Cuatrecasas, Schultes & Smith 12448K* (US).

VENEZUELA: Anzoategui: Cerro Peonia, 2350 m, *Steyermark 61684 p.p.* (F); Estado Bolívar: Ptari-tepuí, 2110 m, *Steyermark 59872 p.p., 59874 p.p., 59878 p.p.* (F); Auyan-tepuí, Río Churún, 1690 m, *Steyermark 93301 p.p., 93313 p.p., 93332* (VEN); Carabobo: La Entrada, *L. Williams 11039* (F); Caracas, Pico de El Avilá, 2000 m, *Alston 5566, 5566 A p.p.* (BM); Las Flores, 1700 m, *Fulford & Steyermark* (Hb Fulford) *1043, 1051 p.p., 1062 p.p., 1072 p.p.;* Mérida: La Gonzáles, 1220–1820 m, *Steyermark 56232* (F); Sucre: Cerro Turumiquire, 2500 m, *Steyermark 62603, 62604a p.p.* (F); Estado Aragua: e of Colonia Tovar, 2000 m, *Steyermark 91605 p.p.* (VEN).

ECUADOR: Andes Quitenses: Tungurahua, 2500 ft, *Spruce* (type MANCH-K 1485; isotype G), same locality, *Spruce* [in packet labeled *L. serpens*] (G); Azuay: s of El Pan, 2650–3290 m, *Steyermark 53364 p.p.* (F).

PERU: Azangaro, *Lechler,* the type of *L. obcuneata* (G-143); s.l., *Weddell,* Hb Montagne (PC).

BOLIVIA: Río Tocorani, *Herzog 4502,* the type of *L. subtilis* (G).

Plate 41

Fig. 7. *Lepidozia squarrosa.* 7 a. Stem, ventral view, × 57. 7 b. Stem leaf, × 57.

Fig. 8. *L. caespitosa.* 8 a. Stem, ventral view, × 45; F, branch of the *Frullania* type. 8 b. Leaf, × 57.

Fig. 9. *L. lindigiana.* 9 a. Stem leaves, × 57. 9 b. Underleaf, × 57.

Fig. 10. *L. jamaicensis.* 10 a. Stem, ventral view, × 45. 10 b. Stem leaf, × 57.

Fig. 11. *L. brasiliensis.* 11 a. Stem, ventral view, × 45. 11 b. Stem leaf, × 57.

Fig. 12. *L. coilophylla.* 12 a. Stem, ventral view, × 33. 12 b. Stem leaf, × 45. 12 c. Branch leaf, × 45.

Fig. 13. *L. cupressina.* 13 a. Stem, ventral view, × 66. 13 b. Stem leaf, × 45. 13 c. Portion of the perianth mouth, × 335.

Fig. 14. *L. pseudocupressina.* 14 a. Portion of the perianth mouth, × 335.

Drawings after J. Taylor, 1960.

9. Lepidozia lindigiana Stephani, Spec. Hep. **3:** 573. 1909; Icon. Hep., *Lepidozia No. 69.*

Plants small, pale yellowish-green; stems pinnate, becoming bipinnate, the lateral branches becoming flagelliform, ventral flagelliform branches frequent. Line of leaf insertion oblique. Stem leaves distant, concave with the apices curved, cuneate, the dorsal base cordate, the margins convex, usually with one or two teeth, quadrifid to one-half or one-third of their length; the segments divergent, unequal, triangular from a 4– to 8-celled base, the apex a uniseriate row of two or three cells; leaf-cells averaging 18 × 18 μ, the walls thickened, the cuticle verruculose. Underleaves rectangular, squarrose spreading, quadrifid to two-thirds of their length, the segments of a row of four to six cells from a 2– to 4-celled base, the margins of the lamina entire or with an obscure tooth. Male and female inflorescences and sporophytes not seen. Pl. 41. Fig. 9, a, b.

Habitat: Not given.

COLOMBIA: Bogotá, *Lindig,* the type (G); also reported by Herzog (1934).

This species seems to be very similar to *L. caespitosa* and differs primarily in the presence of a few teeth on the margins of the lamina of the leaf and underleaf.

10. Lepidozia jamaicensis Stephani, Spec. Hep. **3:** 568. 1909; Icon. Hep., *Lepidozia No. 63.*

Plants small, in dull green to brownish mats, or among other bryophytes; stems to 4 cm long, with leaves to 0.8 mm wide, bipinnately branched, the lateral branches 2 mm apart, becoming attenuate flagelliform in the outer part, ventral branches not seen. Line of leaf insertion oblique. Stem leaves distant to imbricate, cuneate with the dorsal base curved, slightly concave, averaging 0.36 mm long, 0.35 mm wide at the base, the margins without teeth, quadrifid to one-half of their length; the segments spreading, unequal, broad-triangular from a base of mostly six to eight cells, ending in an acute tip of two cells; leaf-cells quadrate to rectangular, 12–18 × 18 μ at the base of a segment, the walls thickened, the trigones tiny, the lumina rounded, the cuticle smooth. Underleaves as broad as the stem, spreading, concave with the segments curved and parallel to the axis, quadrified to one-half or more, the segments triangular from a base of three or four cells and ending in a row of two or four cells. Sexual branches and sporophytes not seen. Pl. 41. Fig. 10, a, b.

Habitat: On trees, and moist logs, in cloud forests.

JAMAICA: s.l., *Börgesen* (type G, isotype C); Fairy Glade, *M. Farr 787 p.p.* (IJ); se slope Mossman's Peak, 5500–6700 ft, *M. Farr 721 p.p., 744, 747* (IJ); Arntully, *Orcutt 3178* (BM; US); Newhaven Gap, *Harris 11001* (BM).

11. Lepidozia brasiliensis Stephani, Spec. Hep. **3:** 571. 1909; Icon. Hep., *Lepidozia No. 46.*

Lepidozia moritziana Stephani, Sv. Vet.-Akad. Handl. II. **23**^{2}**:** 24. 1897. (Nomen nudum.); Stephani, Spec. Hep. **3:** 575–576. 1909; Icon. Hep., *Lepidozia No. 71.*
Lepidozia fulva Stephani, Spec. Hep. **3:** 569. 1909; Icon. Hep., *Lepidozia No. 58.*

Plants of small to medium size, yellow-green, fleshy, in weak tufts or scattered among other bryophytes; stems to 2 cm or more long, with leaves to 0.6 mm wide, regularly pinnate, the lateral branches 2 mm apart, becoming attenate, flagelliform, the ventral flagelliform branches occasional, long. Line of leaf insertion curved around the stem, slightly oblique. Stem leaves closely imbricate, squarrose, concave, ascendent to incurved in the outer part, 0.3–0.5 mm long, 0.5 mm wide at the base, the dorsal margin convex, quadrifid to one-third of the length; segments unequal, triangular from a 3- to 5-celled base, tapering to the acute apex with a 1- or 2-celled tip; leaf-cells quadrate to rectangular, 14–18 × 18 μ at the base of a segment, the walls thickened, the lumina rounded, the cuticle verruculose. Underleaves a little broader than the stem, round-quadrate, quadrifid to one-half on their length or less, the segments triangular from a 2- to 4-celled base, ending in a tip of one or two cells. Sexual branches and sporophytes not seen. Pl. 41. Fig. 11, a, b.

Habitat: On trunks of trees and decaying logs in moist forests.

VENEZUELA: Mérida, *Moritz 74*, the type of *L. moritziana* (G).

BRAZIL: Minas Gerais: s.l., *Dusén*, (type G); S. Catarina: Campos des Padres, 1600 m, *Sehnen 7049* (Hb Sehnen); Rio Grande do Sul: Serra de Rocinha, Aparados da Serra 1000–1200 m, *Sehnen 1003, 1005, 1009, 2765 p.p., 6336* (Hb Sehnen); Rio do Touro, 900 m, *Sehnen 5944* (Hb Sehnen); São Francisco de Paula, 900 m, *Sehnen 4599* (Hb Sehnen); near Santa Theresa, 900 m, *Sehnen 7969* (Hb Sehnen); without locality, *Ule 231*, type of *L. fulva* (G).

ECUADOR: Loja: near La Entrada, 2500–3500 m, *Steyermark 54445 p.p.* (F); Gualaquiza, *Allioni, Bryo. E. Levier Amer. Merid.* (G).

The species has also been reported from Cuba, Haiti and the Dominican Republic (Arnell, 1956a), Costa Rica (Herzog, 1938a), Colombia (Herzog, 1955b) and Brazil (Stephani, 1897).

12. Lepidozia coilophylla Taylor, London Jour. Bot. **5:** 370. 1846.

Lepidozia laxepinnata Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 360. 1885.
Lepidozia plumaeformis Spruce, Rev. Bryol. **15:** 33. 1888. (nomen nudum)
Lepidozia plumaeformis Spruce, Bull. Soc. Bot. France (Suppl.) **36:** 199. 1889.
Lepidozia brevifissa Stephani, Spec. Hep. **3:** 567. 1909; Icon. Hep., *Lepidozia No. 23.*
Lepidozia cavifolia Stephani, Spec. Hep. **3:** 577. 1909; Icon. Hep., *Lepidozia No. 50.*

Plants of medium size or larger, pale green to greenish-brown, in loose mats or scattered among other bryophytes; stems 5–10 cm long, with leaves to 1.2 mm wide, prostrate to ascending, irregularly pinnate to bipinnate, the branches mostly 3 mm apart, to 1 cm or more long becoming flagelliform at the tips, ventral flagelliform branches occasional. The line of leaf insertion oblique. Stem leaves distant to subimbricate, ovate-truncate, 0.4–0.6 mm long, 0.7 mm broad at the base, concave, quadrifid to less than one-third; segments short, broadly triangular from a 3- to 4-celled base, acute, incurved; leaf cells at the base of the segments 18–24 × 18 μ, the walls scarcely thickened, the lumina rounded, the cuticle smooth. Stem underleaves quadrate to longer than broad, not as wide as the stem, concave, 0.5 mm broad at the base, quadrifid to one-third or one-half, the segments triangular from a 3- to 5-celled base, the apex broad, blunt or acute. Branch leaves and underleaves much larger, with the segments often shorter and blunt. Plants dioicous. Male inflorescence with bracts and bracteoles in 6 or more series, the bracts concave, bifid to one-fifth, the segments acuminate; antheridia solitary, very large. Female bracts and bracteoles in three or four series, the inner bracts divided to one-fourth into four or five triangular segments, the margins entire. Perianth mouth entire. Sporophyte not seen. Pl. 41. Fig. 12, a–c.

Habitat: In deep shade in forests, on soil, rocks, and on tree trunks.

VENEZUELA: Amazonas: Serrania Parú, Cumbre forest, 2000 m, *Cowan & Wurdack 31274* (NY); Estado Bolívar: Quebrada O-paru-má, 915–1065 m, *Steyermark 60561a* (F); slopes of Chimantá-tepuí, 1000–1700 m, *Steyermark & Wurdack 75441* (NY).

BRITISH GUIANA: Roraima range, *McConnell & Quelch 552* (G-49).

SURINAME: Table Mountain, Lisie Creek, *Maguire 24408H* (NY).

BRAZIL: Minas Gerais: Gongo Soco, *Bunbury* (type G); Caraça, *Wainio,* the type of *L. brevifissa* (C, G); Caraça, ex Hb Brotherus (G); Rio de Janeiro, *Glaziou 1265* (as *L. plumaeformis*) (G-249), *4535* (NY), *7135,* the type of *L. plumaeformis* (G-246); S. Paulo: near Itapecerica, *Schiffner 1264 p.p.* (W); "Basso Grande," *Schiffner 4283, Crypt. Exs. Mueso Hort. Nat. Vindobonense* (Br, C, W); s.l., *Ule 419,* the type of *L. cavifolia* (G); s.l., *Ule 389* (G-50); Apiahy, *Puiggari* (G-248); Santa Catarina: Monte Crista, Garuva, 900 m, *Reitz & Klein 10085* (HER).

PERU: Andes Peruvianos: Guayrapurina et Campana, 900–1200 m, *Spruce,* the type of *L. laxepinnata* (MANCH-Kk 1488, isotypes BR, G-47,-48, NY).

BOLIVIA: Yungas, 4000 ft, *Rusby 3046* (as *L. plumaeformis*) (G-251). S. Carlos bei Mapiri, 850 m, *Buchtien 275 p.p.,* (Hb Herzog).

12a. **Lepidozia coilophylla** var. **apiculiloba** (Stephani) Fulford, comb. nov.

Lepidozia apiculiloba Stephani, Spec. Hep. **6**: 321. 1922; Icon. Hep., *Lepidozia No. 40.*
Lepidozia kaulfussiana Stephani, Spec. Heb. **6**: 331. 1922; Icon. Hep, *Lepidozia No. 65.*

The margins of the leaves and underleaves of the variety have occasional blunt teeth formed by partly projecting cells.

Habitat: Not given.

BOLIVIA: San Carlos bei Mapiri, 850 m, *Buchtien 275 p.p.* = var. *apiculiloba* (Hb Herzog); San Antonio, M. Mapiri, *Buchtien,* the type of *L. apiculiloba* [= var.]; Mapiri, *Buchtien,* the type of *L. kaulfussiana* [= var. *apiculiloba*] (G).

This species has also been reported from Bolivia (Spruce, 1890), Brazil (Herzog, 1925a–1927; Stephani, 1893b) and Peru (Stephani, 1905b).

13. **Lepidozia cupressina** (Sw.) Lindenberg in G. L. & N., Syn. Hep. 207. 1845.

Jungermannia cupressina Swartz, Prodomus 144. 1788.
Jungermannia reptans β pinnata Hooker, Brit. Jung. *pl. 75, f. 12.* 1815.
Lepidozia pinnata Dumortier, Recueil Obs. Jungerm. 19. 1835.
Mastigophora cupressina (Swartz) Trevisan, Mem. Ist. Lomb. III. **4**: 416. 1877.

Plants of medium to large size, pale green to yellow-green or light brown, in dense mats or more rarely scattered among other bryophytes; stems to 9 cm long, with leaves to 1.0 mm or more wide, prostrate to suberect, closely pinnate or rarely bipinnate; lateral branches frequent, densely leafy, to 1.7 cm long, decurved, often becoming attenuate, long-flagelliform in the outer part; ventral flagelliform branches long. Rhizoids from the scale leaves of the flagelliform branches. Line of leaf insertion oblique. Stem leaves imbricate, asymmetric, broadly ovate, concave, 0.64–0.8 mm long, 0.6–0.8 mm wide at the base, the dorsal lamina strongly arched, the margins essentially without teeth, quadrifid to one-half or less; segments unequal, long triangular, incurved, the base to seven or ten cells wide, narrowed to an acuminate tip of a row of two or more cells 18–24 μ long; leaf-cells at the base of the segment quadrate to longer than broad, 18–24 μ long, the walls thickened, the trigones distinct, the lumina rounded, the cuticle verruculose. Underleaves large, imbricate, as wide or wider than the stem, longer than broad, quadrifid to one-half or less, the segments tapering from a 2–, 4– or 6-celled base, ending in a row of one to three or more cells 18–24 μ long. Plants dioicous. Male bracts and bracteoles in four to six series, the bracts concave, incised above. Female bracts and bracteoles in three series, hyaline or light green, the inner series broadly orbicular, divided above into three to five short, irregular segments. Perianth 6 mm long, whitish, cylindrical, contracted above, the mouth lobate, subentire. Spores yellow-brown, 13–15 μ in diameter, verrucose; elaters 375×10 μ, bispiral. Pl. 41. Fig. 13, a–c.

Habitat: In mountain forests on soil, rocks, stumps and logs, and trunks of trees.

CUBA: Oriente: crest of Sierra Maestra, *Morton 9324* (US); Sierra Maestra, 1100–1400 m, *Ekman 7116* (S-PA).

JAMAICA: s.l., *Swartz,* (type G); s.l., *Swartz* (C, PC); Blue Mountain, *Orcutt 3162* (BM, US), *Hansen* (C); Cinchona, C. *Cumings* (NY); summit of East Peak, *Powell & M. Farr 1021* (IJ); Hardwar Gap, *Baxter 28 p.p., 63* (KANU); base of John Crow Peak, *Underwood 2365* (NY); Morce's Gap, 5000 ft, *Underwood* (NY), *Harris* (NY); slope of Mossman's Peak, *M. Farr 733* (IJ); below Newhaven Gap, 1500–1600 m, *Maxon & Killip* (NY); trail, Newhaven Gap to Sir John Peak, *M. Farr 897* (IJ); Portland Gap, *Proctor 1011* (IJ), *Baxter 46 p.p.* (KANU); s.l., *Evans 107* (Y); s.l., *Börgensen* (C).

HAITI: Morne des Commissaines, *F. Makaness 10, 11, 1310* (MICH); slope of "Ma Blanche," 1400 m, *Ekman 551* (S-PA); Badeau, 2100 m, *Ekman 7697* (S-PA).

MEXICO: Oaxaca: Chinantla, *Santos 3483* (Hb. Fulford); Puebla: Río Tenango below Necaxa, 4000 ft, *Sharp 3121* (TENN); Mirador, *Liebmann 97, 111, 211a, 221, 223, 350, 353, 398a, 543* (C); Mirador, ex Hb Gottsche, Hb Montagne (PC).

GUATEMALA: El Progreso; between Calera and summits of Volcán Siglo, 2200–3300 m, *Steyermark 43124* (F); Jalapa: Volcán Jumay, 1300–2200 m, *Steyermark 32491* (F); Alta Verapaz (?), *Standley 91601* (F).

HONDURAS: Morazán: Cerro Uyuca, 1600–1800, *Standley, Williams & Molina, R., 8023 p.p.* (F).

It has also been reported for the following areas: Cuba (Arnell, 1956), Jamaica (Boswell, 1887), Haiti (Arnell, 1956), Barbados (G. L. & N., 1845), Trinidad (G. L. & N., 1845), Mexico (Gottsche, 1863, Jovet Ast, 1959), Colombia (Hampe, 1847; Gottsche, 1864), Brazil (G. L. & N., 1845), Bolivia (Spruce, 1890), Patagonia (Herzog, 1940, 1954; Reimers, 1926; Stephani, 1900b, 1901a), and Tierra del Fuego (Massalongo, 1885, 1927; Stephani, 1901a; Evans, 1898).

The species seems to be fairly common in the West Indies and Central America and has been reported from numerous areas of South America. *Lepidozia pinnata* (Hook.) Dum. which is known from Ireland, western Britain, Norway, western and Central France, Baden, Germany, the Azores, Madeira and Yunan, China is a northward extension of *L. cupressina.* It also is reported in Africa. The next species, *L. pseudocupressina* belongs to this same species-complex.

14. Lepidozia pseudocupressina Schiffner, Krit. Bemerk. Eur. Leberm. **14:** 8–9. 1919.

Lepidozia allionii Stephani, Spec. Hep. **6:** 320. 1922; Icon. Hep., *Lepidozia No. 38.*

Both Schiffner and Miss Taylor (1960) have pointed out that the vegetative plants of this species are almost identical with robust plants of *L. cupressina* except for the perianths. The plants are coarse, pinnately branched, the large leaves have broadly triangular segments, and the large underleaves are divided to the middle into four lanceolate segments. The perianth mouth is ciliate, with the cilia from two to five cells long, while in *L. cupressina* the perianth mouth is subentire. Pl. 41. Fig. 14, a.

Habitat: Epiphytic on tree ferns, trees, and on rotten wood.

BRAZIL: Sta. Catarina: Serra Geral, *Ule,* (type G); Rio Grande du Sul: São Francisco de Paula, *Sehnen 5326* ♀ (Hb Sehnen). Santa Catarina Serra da Bôa Vista, São José, 1000 m, *Reitz & Klein 9885* (HBR); Araranguá, Serra da Pedra 1000 m, *Reitz 376* ♂ (HBR); S. Paulo: Alto de Serra, 900 m, *Schiffner 1706 p.p.* (W).

ECUADOR: s.l., *Allioni 751* ♀ and per., the type of *L. allionii* (G); Oriente—V. Bomboiza, Gualaquiza, 1000 m., *Allioni 507, 713* [sterile] (G); Azuay: Páramo del Malanga, 3400 m, *Allioni 671* [sterile] (G).

BOLIVIA: Sillar, 1800 m, *Herzog 2713* (G); Tablas, *Herzog 4549* ♀, no perianth (G).

15. Lepidozia münchiana Stephani, Spec. Hep. **3:** 578. 1909; Icon. Hep., *Lepidozia No. 72.*

Lepidozia hampeana Lindenberg & Gottsche, Spec. Hep. **6:** 50. 1846. *p.p.* [Mexican plants.] [Non *L. hampeana* Lindenberg in G. L. & N. Syn. Hep. 208. 1845.]
Lepidozia truncatella var. γ Lindenberg & Gottsche, Spec. Hep. **6:** 45. 1846.
Lepidozia truncatella var. β Gottsche, Mex. Leverm. 128. 1863. [Mexican plants.]
Lepidozia sandiensis Stephani, Spec. Hep. **3:** 577. 1909; Icon. Hep., *Lepidozia No. 78.* [not of the type, = *L. peruviensis.*]

Plants of medium to large size, green becoming tinged with brown, in deep springy mats or loose tufts; stems 10 cm or more long, with leaves to 1.5 mm wide, regularly pinnately branched, the lateral branches 8–10 mm long, rarely branched, becoming attenuate flagelliform toward the tips, ventral flagelliform branches infrequent. Rhizoids from the scales near the tips of flagelliform branches. Line of leaf insertion somewhat oblique. Stem leaves imbricate or distant, asymmetric, broadly ovate, truncate, concave, averaging 0.75 mm long, 0.8–1.2 mm wide at the base, the lamina orbicular, the dorsal margin strongly convex to semicordate, the margin with an occasional projection, the ventral margin sometimes with a slender tooth, quadrifid to two-fifths or more of their length; segments unequal, spreading or incurved, long-triangular from a broad base of seven (the ventral one) to thirteen cells across and tapering to a slender, acuminate apex with a 3-celled tip; leaf-cells quadrate to rectangular, 18–27 × 18 μ, the walls thickened, the lumina rounded, the cuticle smooth to verruculose. Underleaves large, wider than the stem, subquadrate, 0.64–0.7 mm long and wide, quadrifid to the middle, the segments long-tapering, the margins of the lamina with usually one slender tooth on each side near the base. Sexual branches and sporophytes not seen. Pl. 42. Fig. 15, a.

Habitat: On the ground or among *Sphagnum* or on logs and trunks of trees in mountain forests.

Many of the plants from the higher elevations of Mexico and Guatemala have considerably smaller, distant leaves and underleaves. Such plants were recognized as *L. hampeana* and later *L. truncatella* var. γ by Lindenberg and Gottsche. Later Gottsche designated the Mexican plants as *L. truncatella* var. β and Stephani named them *L. sandiensis*, citing both Mexican and Peruvian specimens. The Peruvian plants belong to *L. peruviensis*. Only an occasional leaf of such stems has a tooth near the dorsal or the ventral base. The underleaves, especially those of the branches, usually have one tooth on either side of the lamina.

MEXICO: s.l., *Münch, Hb Levier 5614* (type G); Chiapas: s of Las Casas, 8000 ft, *Sharp 3438 p.p., 3480, 3484b* (TENN); e of Las Casas, 7500 ft, *Sharp 4702* (TENN); n slope sierra n of Mapastepec, *Sharp 4585 p.p.* (TENN); Oaxaca: n of Niltepec, 500 ft, *Sharp 5777;* 3000 ft, *Sharp 5784 p.p.* (TENN); sierra near Rio Grande, 4000 ft, *Sharp 5699* (TENN); Cerro de Sempoaltepec, *Liebmann 176a, b* (C); Rosayaga-Tonaguca. 4000–5000 ft, *Liebmann 295a* (C); Santiago Amatlán, 6000 ft, *Liebmann 299* (C). [All as *L. hampeana.*] Oaxaca: Talea, 5000 ft, *Liebmann 255c, 258a* (C), *260a,* the type of *L. truncatella* var. γ (C) = type of *L. sandiensis*

Plate 42

Fig. 15. *Lepidozia münchiana.* 15 a. Stem, ventral view, × 45.

Fig. 16. *L. wallisiana.* 16 a. Stem, dorsal view, × 45. 16 b. Stem leaf, × 57. 16 c. Cells of the tip of a leaf segment, × 350. 16 d. Underleaf, × 57.

Fig. 17. *L. inaequalis.* 17 a. Stem, ventral view, × 33. 17 b. Stem leaf, × 45. 17 c. Cells of the tip of a leaf segment, × 350.

Fig. 18. *L. macrocolea.* 18 a. Stem, ventral view, × 45. 18 b. Stem leaf, × 57.

Fig. 19. *L. armata.* 19 a. Stem, ventral view, × 30. 19 b. Leaves, × 57. 19 c. Underleaf, × 57.
Drawings, except 16 c and 17 c, after J. Taylor, 1960.

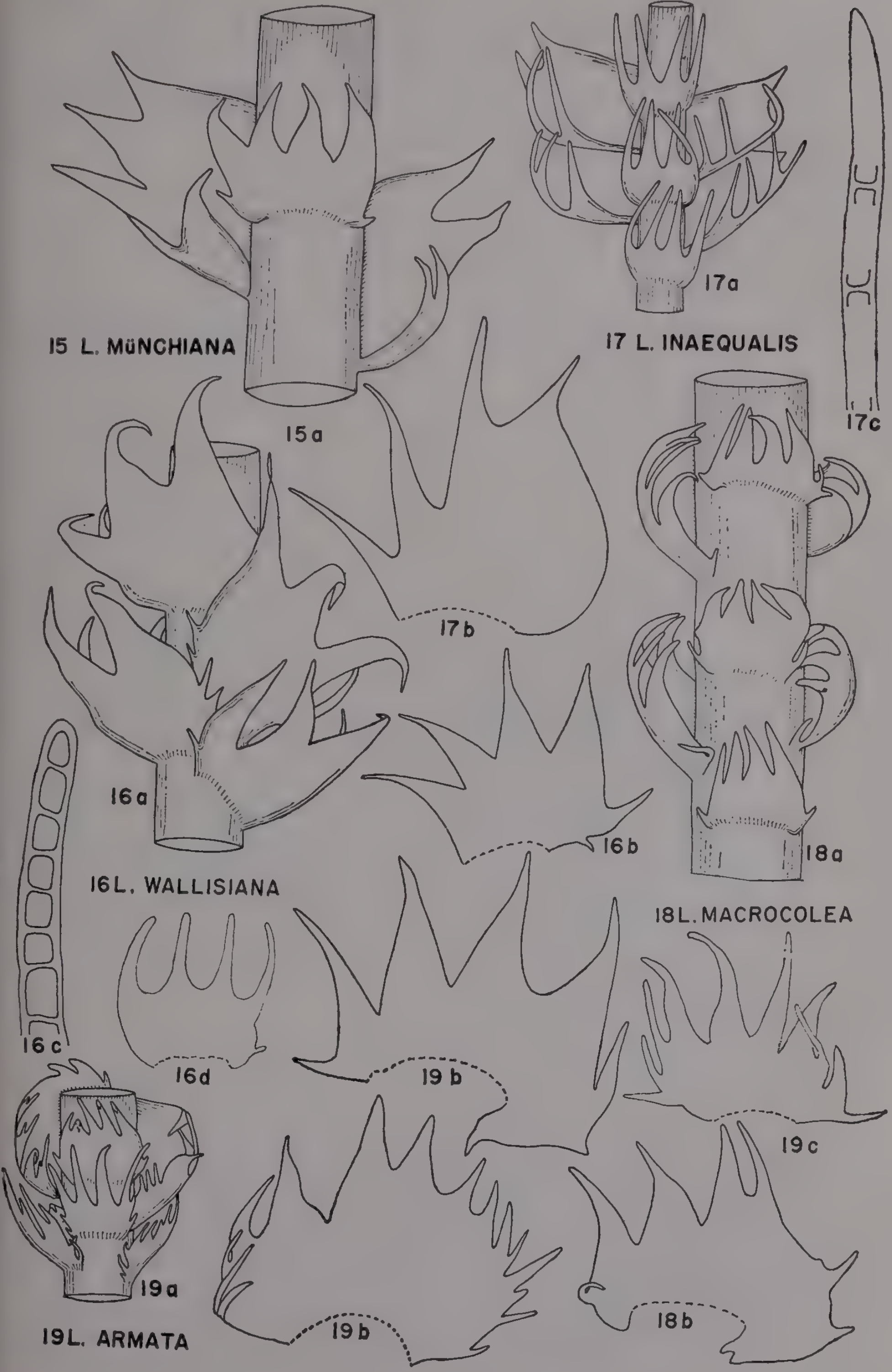
15 L. MüNCHIANA
17 L. INAEQUALIS
16L. WALLISIANA
18L. MACROCOLEA
19 b
19L. ARMATA

Plate 42

(G); Hildago: Cerro de Tutotepec, 6000 ft, *Sharp 5631b* (TENN); San Luis Potosí: w of Xilitla, 3900 ft, *Sharp 5962* (TENN).

GUATEMALA: El Progreso: Finca Bucaral, 6200 ft, *Sharp 2733, 2736 p.p.* (TENN); Sierra de Las Minas, 2500 m, *Steyermark 29828* (F); Zacapa: Sierra Virgen, 2200–2400 m, *Steyermark 42621* (F); Huehuetenango: above Macx, 2500–3000 m, *Steyermark 51899* (F); Puente Alto, 7700 ft, *Sharp 4903 p.p.* (TENN).

HONDURAS: near El Achote, *Yuncker 6583* (DPU).

COSTA RICA: Los Angeles de San Ramón, *Brenes 14859 p.p.* (F); Prov. Cartago: El Empalma, 2400 m, *Lems 5147* (NY).

16. Lepidozia wallisiana Stephani, Spec. Hep. **3:** 573. 1909; Icon. Hep., *Lepidozia No. 86.*

Lepidozia bogotensis Stephani, Spec. Hep. **3:** 570. 1909; Icon. Hep., *Lepidozia No. 60.*
Lepidozia bicalcarata Stephani, Spec. Hep. **3:** 573. 1909; Icon. Hep., *Lepidozia No. 43.*
Lepidozia flavescens Stephani in Herzog, Bryophyten . . . Bolivia. Bibliot. Bot. **87:** 226. *f. 168 a, b.* 1916.
Lepidozia heterophylla Stephani in Herzog, Bryophyten . . . Bolivia. Bibliot. Bot. **87:** 226. 1916; Icon. Hep., *Lepidozia No. 60.* Nomen nudum.
Lepidozia capilliramea Stephani, Spec. Hep. **6:** 323. 1922; Icon. Hep., *Lepidozia No. 48.*
Lepidozia caracensis Stephani, Spec. Hep. **6:** 322. 1922; Icon. Hep., *Lepidozia No. 49.*

Plants of medium size, olive-green to dark green or brown, in dense tufts or mats or among other bryophytes; stems to 5 cm or more long, with leaves to 1.2 mm broad, regularly pinnately branched, the lateral branches 2–3 mm apart, 0.5–1.0 cm long, often becoming flagelliform, ventral flagelliform branches infrequent. Line of leaf insertion oblique. Stem leaves distant to contiguous or imbricate, asymmetric, squarrose-spreading, a little concave, to 0.48 mm long, 0.48–0.56 mm broad at the base; the lamina more or less orbicular, the dorsal margin strongly convex from a rounded base, usually with slender teeth one to several cells long, the short ventral margin with or without a tooth, obliquely quadrifid to one-half their length; segments unequal, triangular from a 4- to 7-celled base, soon narrowed to a long acuminate uniseriate tip of four to seven cells 20–27 μ or rarely a few to 36 μ long, the apices of most of the segments curved upward on the ventral side of the stem; cells of the base of the segments quadrate, 17–22 μ long and broad, the walls thickened, the cuticle smooth. Underleaves as broad as the stem, concave, quadrifid to one-half or more, the lamina with or without one or more teeth on either side, the segments two to four cells broad at the base, soon becoming uniseriate for five to seven cells, divergent, curved and parallel to the stem; the cells to 27 μ long. Sexual branches and sporophytes not seen. Pl. 42. Fig. 16, a–d.

Habitat: On logs and trees in cloud forests.

GUATEMALA: Zacapa: slopes of Volcán Gemelos 2100–3200 m, *Steyermark 43291 p.p.* (F).

COLOMBIA: Antioquia: Páramo de Sonsón, *Wallis,* (type G); same locality and collector, the type of *L. bicalcarata* (G); same locality and collector, 10,000 ft, neotype of *L. capilliramea* (G); the same, ex Hb Jack (G); the same, as *L. dendritica* (G); [the citation in Stephani, 1922, "Fretum Magellanicum, Skottsberg leg." is incorrect.] Bogotá: San Cristóbal, *Apollinaire,* the type of *L. bogotensis* (G).

VENEZUELA: Amazonas; Cerro Duida, 305–1095 m, *Steyermark 57985 p.p.* (F). Caracas, 4500 ft, *Funck & Schlim 350 bis,* the type of *L. caracensis* (G); Cerro Huachamacari, *Maguire, Cowan & Wurdack 29907* (NY); Bolívar: Sarvén-tepuí, *Wurdack 34331* (NY); Quebrada O-paru-má, 1065–1220 m, *Steyermark 60446, 60448 p.p.* (F); Lara: slopes of Palojosco 2375–2530 m, *Steyermark 55240* (F); Chimantá Massif, above valley of Río Tirica, 1000–1700 m, *Steyermark 75441* (NY); Sucre, Cerro Patao, *Steyermark & Agrostini 91003, 91373* (VEN).

ECUADOR: Pichincha, *Bell 420* (BM).

PERU: s.l., without collector, no. *208,* ex Hb Jack, as *J. pendulina* (G-239).

BOLIVIA: Lagunillas in valle Tocorani, 3000 m, *Herzog 3481,* the type of *L. flavescens* (G); Tablas, 3400 m, *Herzog 4556,* the type of *L. heterophylla* (G); Cochabamba; Inca Corral, 2200–2300 m, *Herzog Bryoth. E. Levier 6018,* as *L. bogotensis* (G).

The plants of this species are highly variable in size and shape of the leaves and underleaves and there is often considerable difference between the leaves and underleaves of the stem and its branches or between those of different stems. The length of the uniseriate tips of the leaves is less on robust than on slender stems, or on branches. There may be no marginal teeth on the dorsal lamina of the stem leaves or several teeth, none on the stem leaves and several on the branch leaves or just suggestions of teeth along the margin. There are very often one or two teeth along the ventral margin. A slender tooth on either side of the lamina is characteristic in the underleaves, but there may be several teeth or none. On some of the more robust plants the teeth are quite long. The cells of the uniseriate tips of the segments are mostly 22–27 μ in length, but some are only 18 μ.

17. Lepidozia inaequalis (Lehmann & Lindenberg) Lehmann & Lindenberg in G. L. & N. Syn. Hep. 209. 1845.

Jungermannia inaequalis Lehmann & Lindenberg in Lehmann, Pug. Pl. **5**: 1. 1833.
Mastigophora inaequalis Trevisan, Mem. Ist. Lomb. III. **4**: 416. 1877.
Lepidozia tenuicuspis Spruce ms., *Hep. Spruc.*
Lepidozia cupressina var. *tenuicuspis* Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 358. 1885.
Lepidozia tenuicula Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 359. 1885.
Lepidozia inaequalifolia Lindenberg in Spruce, Rev. Bryol. **15**: 34. 1888. Nomen nudum.
Lepidozia boliviensis Stephani, Spec. Hep. **3**: 571. 1909; Icon. Hep., *Lepidozia No. 45/46.*
Lepidozia tenuicuspis Stephani, Spec. Hep. **6**: 342. 1922; Icon. Hep., *Lepidozia No. 83.* Non Spruce.

Plants large, pale greenish-yellow becoming brown, in mats or mixed with other bryophytes; stems to 6 cm or more long, with leaves 1.2 mm wide, prostrate to ascending, regularly pinnate or bipinnate, the lateral branches frequent, densely leafy, to 1.6 cm long, often becoming attenuate flagelliform at the tip, ventral flagelliform branches scarce. Rhizoids with expanded tips, from the scales of flagelliform branches. Line of leaf insertion oblique. Stem leaves closely imbricate, squarrose, concave, 0.8–1.2 mm long, 1.1 mm wide at the base, the dorsal lamina semicordate, the margins essentially entire, divided to one-fourth their length into four or five segments; segments long, unequal, triangular, often flexuose, ending in a uniseriate row of four to nine cells 30–36 μ long, from a base three to eleven cells wide, the two segments on the ventral side of the leaf often bent parallel to the stem; leaf cells of the base of the segments averaging 18 μ, the lumina rounded, the walls thickened, the cuticle verruculose. Underleaves large, broader than the stem, longer than broad, to 0.4 mm wide, divided to one-half or two-thirds their length into four or five long, slender, uniseriate segments six to nine cells long from a 2- to 4-celled base, the cells 30–36 μ long. Female bracts and bracteoles in three or four series, the innermost series broadly ovate, divided to one-fourth their length into four or five laciniae. Perianth long, contracted above, the mouth ciliate. Male inflorescence and sporophyte not seen. Pl. 42. Fig. 17, a–c.

Habitat: In mountain forests on trunks of trees and rotten logs.

BRAZIL: Nova Friburgo [Rio de Janeiro], *Beyrich, ex Hb Lehmann* (type PC), the same, ex Hb Hooker (NY), the same, ex Hb Rom (G); Rio de Janeiro, *Glaziou 4523* (C, G), *4523 bis* (G-5), *11738* (BR, G-9), *11738* as *L. inaequifolia* (G-1); Rio de Janeiro, *Schiffner 815 p.p.* (W); s.l., *Ule 230, 372* (G); Sa. Orgãos, *Weddell*, Hb Montagne (PC); Minas Gerias: Caraça, *Wainio*, ex Hb Brotherus *55* (G-14); Caraça, *Wainio* (C); Serra Itatiaia, 2100 m, *Dusén 362* (G-11), *3928* (G). Santos, *Warming* (G-29); S. Paulo: Alto da Serra, *Hoehne 85* (G-3); Alto da Serra, *Schiffner*, 900 m. *Crypt. exsic. Mus. Hist. Nat. Vindobonenses 4282* (BR), *4284* (C); Barra Mansa, *Schiffner 495 p.p., 536 p.p.* (W). Paraná: Villa Velha, *Dusén 4193* as f. *minor* (G-13); Apiahy, *Puiggari 314* (G-4), *315* (G), Serra do Mun, Mt. Alegre, *Dusén 3928* (G-8); Terra do Mar, *Dusén* (NY); Curitiba, *Hb E. Levier 2999 bis* (G-10). Santa Catarina: Pto Uniao, *Reitz & Klein 1359* (HBR).

ECUADOR: Azuay: Gualiquiza, [*Allioni*], ex Hb E. Levier, the type of *L. tenuicuspis* Steph. (G-404).

PERU: Andes Peruviana: Guayrapurina, *Spruce, Hep. Spruc.*, as *L. tenuicula* (G-401); M. Campana, *Spruce, Hep. Spruc.*, type of *L. cupressina* var. *tenuicuspis* = *L. tenuicuspis* Spruc. (MANCH-K 1491), isotype (G-403).

BOLIVIA: Cochabamba: Tablas, 3400 m, *Herzog 2856a*, the type of *L. boliviensis* (G); Paradise, 4500 ft, *Williams 2154* (NY).

This species was also reported from Brazil by Herzog (1925a), Jack & Stephani (1892) and Stephani (1893b).

18. **Lepidozia macrocolea** Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 363. 1885.

Plants of medium size, olive-green to yellowish-brown, becoming deeply pigmented, in loose tufts to dense mats, sometimes among other bryophytes; stems to 5–7 cm or more long, with leaves about 0.6 mm wide, regularly pinnate to bipinnate, the branches 2 mm apart, 0.5–1.0 cm long, often becoming flagelliform at the tips, ventral branches not seen. Line of leaf insertion oblique. Stem leaves subimbricate, squarrose, concave, curved upward in the outer part, subquadrate, 0.48–5.6 mm long, 0.56–0.8 mm broad at the base, the dorsal margin of the lamina convex, semicordate, entire or with one or more spinose teeth, the ventral margin shorter, often with one or two teeth, quadrifid to one-half of their length; segments unequal, triangular to lanceolate from a 2- to 6-celled base and ending in a 2- or 3-celled tip; cells of the base of the segment 18–24 × 18 μ, with strongly thickened walls and rounded lumina, the cuticle smooth. Underleaves as broad as the stem, broader than long to quadrate, the lateral margins convex, with usually one tooth, quadrifid to the middle or more, the segments narrowly triangular, often two cells broad for much of their length and ending in a uniseriate tip of two or three cells. Sexual branches and perianths not seen. Pl. 42. Fig. 18, a, b.

Habitat: On soil, rock faces and trunks of trees in forests.

COLOMBIA: Vaupés: Río Kananarí, *Schultes, Cabrera & Bell 13375* (FH); Cauca: Macizo Colombiano, Páramo de Las Papas, *Bischler 937* (COL); Huila-Cauca: Páramo de Las Papas, *Bischler 769 p.p., 787, 816, 825 p.p.* (COL). Cundinamarca: Venecia, Pandi, *Killip 639 p.p.* (US); Santander: mesa de Los Santos, 1500 m, *Killip & Smith 15304* (US).

VENEZUELA: Amazonas: Cerro Duida, 1095–1520 m, *Steyermark 58019* (F); Estado Bolívar; Abácapa-tepuí, *Steyermark 75217 p.p.* (NY); se Cerro Venamo, 1220–1275 m, *Steyermark & Dunsterville 92737* (VEN); Auyan-tepuí, Río Churún, 1600–1850 m, *Steyermark 93313 p.p., 93338, 93354, 93436, 93848* (NY): above Maracay, 1600 m, *Magdefrau 490* (Hb Fulford).

BRAZIL: s.l., *Burchell 3571* (BM).

ECUADOR: Andes Quitenses, Mt. Tungurahua, *Spruce, Hep. Spruc.* (type MANCH, isotypes BR, G-65).

This species seems to be closely allied to the next.

19. Lepidozia armata Stephani, Spec. Hep. **3:** 567. 1909; Icon. Hep., *Lepidozia No. 22.*

Lepidozia karstenii Stephani, Spec. Hep. **3:** 576. 1909; Icon. Hep., *Lepidozia No. 64.*
Lepidozia karstenii var. *standleyi* Herzog, Revue Bryol. Lichénol. **11:** 22. 1938 [1939].

Plants of medium or large size, in dense, pale yellowish-green, deep green or brown tufts or mats; stems prostrate or ascending to erect, to 10 cm or more long, 1 mm or more wide, densely bi- or tripinnate; lateral branches 1–2 mm apart, to 2 cm long, usually becoming attenuate-flagelliform with decurved tips, ventral flagelliform branches occasional. Line of leaf insertion curved around the stem, slightly oblique, the upper end often slightly recurved. Stem leaves approximate to imbricate, to 0.65 mm long, 0.5 mm wide at the base, asymmetric and broadly orbicular to subquadrate, divided to one-half their length or more into four to six unequal, narrowly lanceolate to broadly triangular segments which may be ciliate or divided, the apex a row of one to six cells, 18–27 μ long, the dorsal side of the lamina semicordate and strongly convex, both margins often incised or toothed; leaf cells at the base of the segments 18 μ or less, quadrate to rectangular, the walls thickened, the cuticle smooth. Underleaves as broad or broader than the stem, quadrate to orbicular, divided to one-half or more into four or more narrow, triangular segments, ending in a 2- to 4-celled tip, the segments and margin of the lamina with few to many cilia or teeth. Sexual branches and perianths not seen. Pl. 42. Fig. 19, a–c.

Habitat: Trunks of trees, rocks and soil in forests.

JAMAICA: Hardwar Gap, 4000 ft, *Baxter 5, 9, p.p., 26* (KANU); w slope of Blue Mountain Peak, *Proctor 736;* Blue Mountain, *Orcutt 3162* (BM, US), *Rehder* (G); Fairy Glade, *M. Farr 529* (IJ), *Welch 17816* (DPU); Morces Gap, 4900 ft, *Harris 10025* (NY), *Harris 10028* (G); s.l., *Börgensen* (C); Greenwich Road, *Welch 17834* (DPU); s.l., *Andrus* (BM); St. Andrews, *Webster 4960, 4969* (MICH).

MEXICO: Cafetal, *Karsten 1894,* the type of *L. karstenii* (G); Hildago, *Sharp 4014* (TENN); Oaxaca, *Santos 3498* (Hb. Fulford); Chiapas: n of Mapastepec, *Sharp 4603* (TENN).

GUATEMALA: Alta Verapaz: near Tactic, 1400–1500 m, *Standley 90413* (F); Cerro Chiblac, 1200–2000 m, *Steyermark 49172D* (F); Zacapa: summit Sierra de las Minas, 2500 m, *Steyermark 29898* (F); upper Río Sitio Nuevo, *Steyermark 43202* (F); Huehuetenango: n of Barillos, *Steyermark 48796* (F); without locality, *Türckheim 5581* (NY); Baja Verapaz, *Sharp 5172* (TENN).

HONDURAS: Comayagua: near Siguatepeque, 1080–1400 m, *Standley 56194 p.p.* (F).

COSTA RICA: S. José: Las Nubes, 1500–1600 m, *Standley 38735, Verdoorn, Hep. Select. & Crit. 375,* the type of *L. karstenii* var. *standleyi* (isotypes BR, C, F); s.l., *Gutierrez B, 186* (F); s.l., *Brenes 11207, 11689* (F); San Ramón: La Palma, *Brenes 16214* (F); Los Angeles de San Ramón, *Brenes 16262* (F); El Silencio de San Ramón, *Brenes 17117 p.p.* (F); Cartago: Santa Clara, *Torres 220 p.p., 234* (F); road near Volcán Barba, 1600–1950 m, *Maxon & Harvey 8470a* (US); s.l., *Motelay,* (G); Cerro de la Carpintera, *Little 5579* (Hb Little); sierra de Talamanca s of Cartago, 7238 ft, *Little 5602* (Hb Little); Limón: La Asuncion, Río Banana, *Gutierrez 186 p.p., 187 p.p., 200 p.p.* (F); La Palma, 1469 m, *Tonduz* (G-11449).

PANAMA: s.l., *Fr. Hélion* (NY); Chirique, *Fr. Hélion* (G).

VENEZUELA: Mérida, *Moritz 71,* ex Hb Berol. (type G); s.l., *Moritz,* ex Hb Bescherelle, as *L. truncatella* var. γ (G-66); s.l., *Moritz,* Hb Montagne (PC): Caracas, without collector, no. *1518* (G-11273).

Additional reports include Costa Rica (Herzog, 1938a) and Bolivia (Müller, 1955).

20. Lepidozia peruviensis Stephani, Spec. Hep. **3:** 575. 1909; Icon. Hep., *Lepidozia No. 74.*

Lepidozia caespitosa var. Spruce ms. *Hep. Spruc.*
Lepidozia quitensis Stephani, Spec. Hep. **3:** 569. 1909; Icon. Hep., *Lepidozia No. 77.*

Plants large, pale green to light brown, in loose tufts or mats or among other bryophytes; stems 5–8 cm long, with leaves to 1 mm broad, mostly ascendent, bi-tripinnate, the lateral branches mostly 5 mm apart, 1–3 cm long, decurved at the tips, sometimes becoming flagelliform, ventral branches not seen. Line of leaf insertion subtransverse to oblique. Stem leaves distant to approximate, asymmetric, ovate, cucullate-concave to saccate, 0.5–0.6 mm long, 0.5 mm wide at the base, the dorsal margin strongly convex, the ventral margin much shorter, to only one-fourth as long, without teeth, obliquely quadrifid to one-fourth of their length; segments unequal, short, incurved, triangular from a 3- to 5-celled base, soon becoming uniseriate with a sharp 2- or 3-celled tip, the cells to 27 μ long; leaf-cells at the base of a segment 18–27×16–18 μ, the walls thickened, the lumina rounded, the cuticle smooth. Stem underleaves distant, not as wide as the stem, quadrifid to one-half of their length, the segments narrowly triangular, with a uniseriate 3- or 4-celled tip, the lamina with convex sides, entire or occasionally with a tooth, almost connate with the leaves on one side of the stem. Branch leaves and underleaves larger, approximate to imbricate, less concave, the uniseriate tips of the leaf-segments longer. Sexual branches and sporophytes not seen. Pl. 43. Fig. 20, a, b.

Habitat: Among *Sphagnum*, over humus, logs, or the bases of trees in moist mountain forests.

COLOMBIA: Cauca: Valle de Las Papas, 2910 m, *Bischler 1012, 1036* (COL); Huila-Cauca: Macizo Colombiano, Páramo de Las Papas, 3530–3630 m, *Bischler 640, 641 p.p., 644, 669, 688, 693 p.p., 823, 824 p.p., 826, 944* (COL).

VENEZUELA: Mérida: La Guada (Pico Espejo), 3350 m, *Magdefrau 659* (Hb Fulford).

ECUADOR: Andes Quitenses: Mt. Tungurahua, *Spruce, Hep. Spruc.*, the type of *L. quitensis* = *L. caespitosa* var. (G-11257).

PERU: Sandia, 3000 m, *Weberbauer 820 p.p.*, as *L. sandiensis* (G-11256); s.l., *Weberbauer 2300* (G); s.l., *Weberbauer 820 p.p.* (type G).

This species is close to the next.

21. **Lepidozia dendritica** Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 362. 1885.

Plants large, green becoming brown, in tufts or mats; stems 5–10 cm long, with leaves to 1.0 mm broad, bi-tripinnately branched, lateral branches 2–3 mm apart, to 8 mm or more long, not becoming flagelliform (?), ventral branches not seen. Line of leaf insertion subtransverse, the upper end bent downward, hook-form. Stem leaves distant to approximate, cucullate-concave, appearing saccate, asymmetric, 0.5 mm long, 0.5–0.8 mm wide at the base, the dorsal margin strongly convex, sometimes semicordate, entire, the ventral margin to only one-fourth as long, with one or two teeth or cilia, obliquely quadrifid to one-third of their length; segments unequal, incurved, triangular from a 4- to 6-celled base, with a

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Plate 43

FIG. 20. *Lepidozia peruviensis*. 20 a. Stem, ventral view, × 45. 20 b. Stem leaf, × 57.

FIG. 21. *L. dendritica*. 21 a. Stem, ventral view, × 33. 21 b. Stem leaf, × 45. 21 c. Stem underleaf, × 45.

FIG. 22. *L. auriculata*. 22 a. Stem leaf, × 45. 22 b. Stem underleaf, × 45. 22 c. Cells of the tip of a leaf segment, × 350.

FIG. 23. *L. andicola*. 23 a. Stem, ventral view, × 30. 23 b. Stem leaf, × 57. 23 c. Cells of the tip of a leaf segment, × 350.

FIG. 24. *L. pinnaticruris*. 24 a. Stem, ventral view, × 45. 24 b. Cells of the tip of a leaf segment, × 350.

Drawings, except 22 c, 23 c, and 24 b, after J. Taylor, 1960.

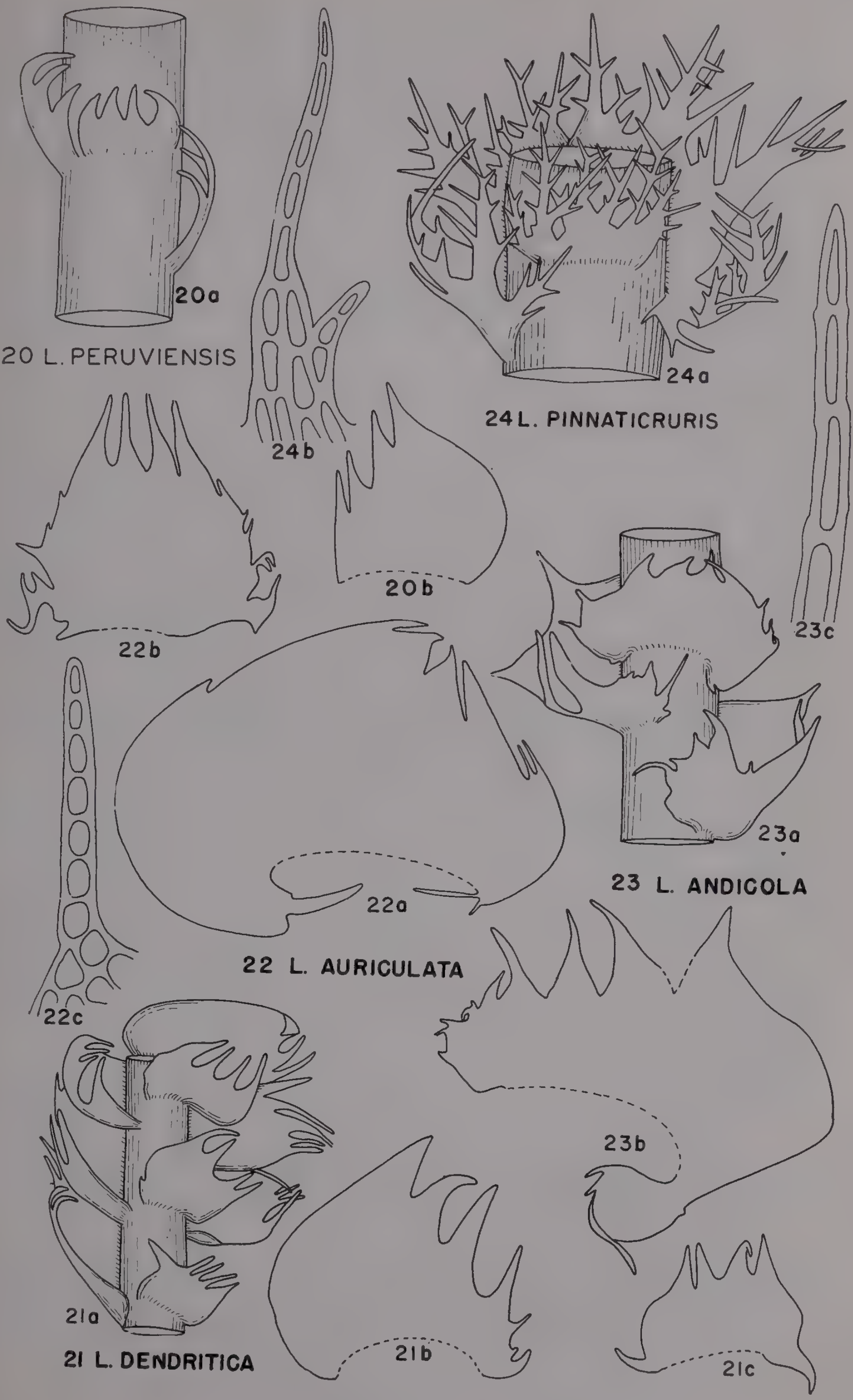
20 L. PERUVIENSIS
24 L. PINNATICRURIS
23 L. ANDICOLA
22 L. AURICULATA
21 L. DENDRITICA

Plate 43

uniseriate tip of two to four cells, 18–24 μ long; leaf-cells at the base of the segments 18–24 × 18–22 μ, the walls thickened, the trigones distinct, the cuticle smooth. Stem underleaves distant, as wide as the stem, concave, quadrifid to one-third or more, the segments narrowly triangular from a 3- to 6-celled base and ending in a 2- to 4-celled tip, the cells 18–24 μ long, the lamina with one or two obscure to well developed teeth on each side. Branch leaves and underleaves larger, less concave, the segments with tips to 10 cells long. Sexual branches and sporophytes not seen. Pl. 43. Fig. 21, a–c.

Habitat: On trunks of trees in mountain forests.

COLOMBIA: Andes Bogotenses, Weir (NY).

ECUADOR: Andes Quitenses: Mt. Tungurahua, *Spruce, Hep. Spruc.* (type MANCH-K 1486, isotypes NY, G-221); Gualaquiza, *Allioni, Bryoth. E. Levier 6411* (G); also reported from Torres (Herzog, 1957a).

22. Lepidozia auriculata Mitten ex Stephani, Spec. Hep. **3:** 579. 1909; Icon. Hep., *Lepidozia No. 42.*

Lepidozia auriculata Mitten ms.

Plants large, robust, greenish to yellowish-brown, stems to 7 cm or more long, with leaves to 1 mm broad, regularly pinnate, rarely bipinnate, dendroid; lateral branches mostly 5 mm apart, short, less than 5 mm long, with decurved tips, occasionally with a short branch, or sometimes longer and becoming long flagelliform, the ventral branches not seen. Line of leaf insertion subtransverse, with a decurved dorsal end. Stem leaves large, distant to imbricate, concave-cucullate, saccate, very broadly orbicular-ovate, to 1 mm long, 1.3–1.5 mm wide at the base, the lamina broadly orbicular, the dorsal margin strongly convex and covering the stem, semicordate to auriculate-appendiculate, the margin with occasional multicellular spines or cilia, with cells 24–27 μ long, the ventral margin shorter, with an occasional tooth, quadrifid to one-sixth or one-eighth of their length; the segments unequal, connivent, short, triangular from a 4- to 8-celled base, ending in a uniseriate tip of two to four cells 18 μ long; leaf-cells at the base of the segments mostly 18–22 × 18 μ, the walls thickened, the cuticle smooth. Stem underleaves as broad as the stem, averaging 0.56 mm long, 0.65 mm wide, ovate-truncate, quadrifid to one-fourth of their length, the segments narrowly triangular from a 4-celled base and ending in a uniseriate tip of four to six cell 18 μ long, the lateral margins with one or two long teeth, a long appendage at the base; branch leaves and underleaves tending to be longer and not so wide, with longer segments and marginal cilia, the cells mostly 18 μ long, never more than 27 μ. Sexual branches and sporophyte not seen. Pl. 43. Fig. 22, a–c.

Habitat: Not given.

PERU: Carabaya, *Weddell* (type G); Carabaya, *Weddell,* Hb Montagne (PC); Chimborazo, *Jameson* (PC); w base of the Andes, *Jameson 48,* Hb Mitten (BR, NY).

In general appearance the species is quite similar to *L. andicola* but the two can readily be separated in that the cells of the cilia and segments of both the leaves and underleaves of *L. andicola* are very long, to 36 μ or more, while those of *L. auriculata* are short, only 18 μ long or very rarely a few 22–27 μ.

23. Lepidozia andicola Beauverd in Stephani, Spec. Hep. **6:** 572. 1924.

Lepidozia appendiculata Stephani, Spec. Hep. **6:** 319. 1922; Icon. Hep., *Lepidozia No. 41.* Non *L. appendiculata* Stephani, Spec. Hep. **3:** 589. 1909.

Plants large, robust, greenish-brown to dark reddish-brown, in deep tufts or mixed with other bryophytes; stems large, coarse, to 10 cm long, with leaves 0.8–1.2 mm broad, regularly bipinnate, dendroid, the lateral branches 5 mm apart, 10–15 mm long, becoming attenuate, long flagelliform at the tips, the ventral branches not seen. Line of leaf insertion subtransverse to oblique, decurved at the dorsal end. Stem leaves large, subimbricate, concave-cucullate, saccate, very broadly ovate, 0.8–1 mm long, 0.8–1 mm broad at the base, the lamina broadly orbicular, the dorsal margin strongly convex and covering the stem, semicordate to auriculate, appendiculate, entire or with occasional long-celled spines and cilia, ventral margin very short, with cilia or teeth, quadrifid to one-fourth of their length or less; segments narrow-triangular from a 2-, 4-, or 8-celled base and ending in a uniseriate tip of three or four cells 36 μ or more long; cells of the base of the segment mostly 16–22 × 16 μ, the walls thickened, the cuticle smooth. Stem underleaves distant, as broad as the stem, orbicular, divided to one-fourth of their length into four or six segments with a few cilia between, the segments two to four cells broad at the base, ending in a uniseriate tip of four or five cells, each cell 36 μ or more long, the margins of the lamina sparsely ciliate. Branch leaves with more segments and supplementary teeth and cilia, the branch underleaves often with so many teeth and cilia that segments as such are not to be recognized. Sexual branches and sporophytes not seen. Fig. 23, a–c.

Habitat: Not given.

COLOMBIA: Cauca: Páramo de Las Papas, 3200–3510 m, *Bischler 904* (COL); Valle: Los Farallones, 3500–3600 m, *Cuatrecasas 17939B p.p.* (US).

VENEZUELA: Mérida: Pico Espejo, 3350 m, *Magdefrau 652* (Hb Fulford).

ECUADOR: Azuay: Río Collay, s of El Pan, 2650–3290 m, *Steyermark 53374* (F).

BOLIVIA: Tablas, 3400 m, *Herzog 2829* (type G).

24. Lepidozia pinnaticruris Spruce ex Stephani, Spec. Hep. **3:** 579. 1909; Icon. Hep., *Lepidozia No. 75.*

Plants robust, olive-green to light brown, in large tufts or among other bryophytes; stems large, to 10 cm long, with leaves to 1.5 mm broad, ascending, bipinnate, the lateral branches 3 mm apart, sometimes becoming attenuate-flagelliform, to 2 cm long, ventral branches not seen. Line of leaf insertion oblique to subtransverse. Stem leaves imbricate, asymmetric, concave, to 1 mm long, to 1.2 mm wide at the base, quadrified to two-thirds; segments regularly ciliate with three or four pairs of opposite cilia, the base of the segment broad, the cells 18–27 × 16–18 μ, the cells of the cilia 24–27 × 10–15 μ, the cuticle striolate. Underleaves subquadrate, quadrified to one-half of their length, the segments and margins ciliate as in the leaf. Female inflorescence frequent, one to several on a stem, the bracts and bracteoles in four series, the bracts of the inner series quadrifid-laciniate to one-fourth of their length. Male inflorescence, perianth and sporophyte not seen. Pl. 43. Fig. 24, a, b.

Habitat: On trees.

COSTA RICA: Cocos I., *Holdridge 5184* (NY).

COLOMBIA: Valle: Córdoba, Dagua valley, 80–100 m, *Killip 5089* (US); La Cumbre, 2100–2400 m, *Killip 11370* (US).

ECUADOR: Mt. Chimborazo, *Spruce* (type G-243).

This large and very beautiful species looks like a large *Trichocolea* rather than a *Lepidozia*. However, in *Trichocolea* the leaves are succubous and the cilia of the leaves and underleaves are made up of very long cells, two or three times as long as the cells of the cilia of *L. pinnaticruris*.

25. Lepidozia chiloensis Stephani, Spec. Hep. **6:** 322. 1922; Icon. Hep., *Lepidozia No. 144*.

Plants large, pale green, in deep, loose tufts; stems to 6 cm long, with leaves to 1.5 mm broad, regularly bipinnate, the lateral branches distant, to 2 cm long, the ventral branches not seen. Line of leaf insertion oblique. Stem leaves large, strongly concave, to 1.5 mm long, 1.9 mm wide quadrified to one-half, the dorsal base semicordate the margin often serrate, the ventral base appendiculate, both margins with several large teeth and a sharp spine at the base or at least distinctly dentate, segments long triangular from a 10- to 20-celled base, the apex slender to acuminate; cells of the base of the segment 18–27 $\mu \times 18$ μ, the walls thick, the cuticle smooth. Underleaves subquadrate to broadly oval, as broad or broader than the stem, quadrifid to one-third of their length, the segments to ten cells wide at the base, the margins of the lamina with one to three coarse teeth. Sexual branches and sporophyte not seen. Pl. 44. Fig. 25, a, b.

Habitat: On humus, and over Sphagnum mounds, in bogs.

PATAGONIA-TIERRA del FUEGO: Chiloe I., *Skottsberg* (type G); Halt Bay, *Cunningham 117 p.p.* (G); Magellan Straits, *Schubert,* Hb Monkemeyer 11 (G); bogs 190 km from Punta Arenas, near Hotel Rubens, *Fulford 247, 251, 254, 256,* (Hb Fulford); cerca de Río Rubens, Turberra, *C. A. & G. Hässel de Menéndez 557* (BA 11149); Riesco I., Punta León, *Fulford & Hatcher 339 p.p., 373 p.p.* (Hb Fulford). Laberinto I., *De Gasperi,* as *L. hastata,* (FI); Lago Roca, *C. A. & G. Hässel de Menéndez 798 p.p.* (BA 11391); Río Azopardo, *Dusén* [115] (G).

26. Lepidozia chordulifera T. Taylor, London Jour. Bot. **5:** 371. 1846.

Mastigophora chordulifera (Taylor) Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Lepidozia hastata Stephani, Spec. Hep. **3:** 605. 1909; Icon. Hep., *Lepidozia No. 56.*
Lepidozia effusa Stephani, Sv. Vet.-akad. Handl. **46**^{9}**:** 62. *f. 23, g–h. 1911.*
Lepidozia fernandesiensis Stephani, Sv. Vet.-akad. Handl. **46**^{9}**:** 63. *f. 24, e.* 1911. [In error, the description and figures have been interchanged with those of *L. disticha,* p. 62, *f. 24, a–b.*]
Lepidozia hariotii Stephani, Spec. Hep. **6:** 329. 1922; Icon. Hep., *Lepidozia No. 155.*
Lepidozia microscopica Stephani, Spec. Hep. **6:** 334. 1922; Icon. Hep., *Lepidozia No. 160/161.*
Lepidozia angulata, Stephani ms. Nomen nudum.
Lepidozia (*Telaranea*) *fernandeziensis* Herzog, Revue Bryol. Lichénol. **23:** 51. 1954. [in error].
Lepidozia truncatella auctt. p.p. [Plants from Patagonia p.p.]

Plants of small to medium size, pale green becoming light brownish-green, in loose mats or tufts; stems to 5 cm long, with leaves 0.5–0.8 mm broad, pinnate to bipinnate, the lateral branches to 5 mm long, rarely becoming flagelliform, often curved downward at the tip and then to 10 mm long; ventral branches not seen. Line of leaf insertion oblique. Stem leaves distant to imbricate, asymmetric, ovate-truncate, to 0.4 mm long, 0.3–0.4 mm wide at the base, the dorsal margins strongly convex from a cordate base, with one or two conspicuous teeth

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Plate 44

FIG. 25. *Lepidozia chiloensis.* 25 a. Stem, ventral view, × 45. 25 b. Stem leaf, × 57.

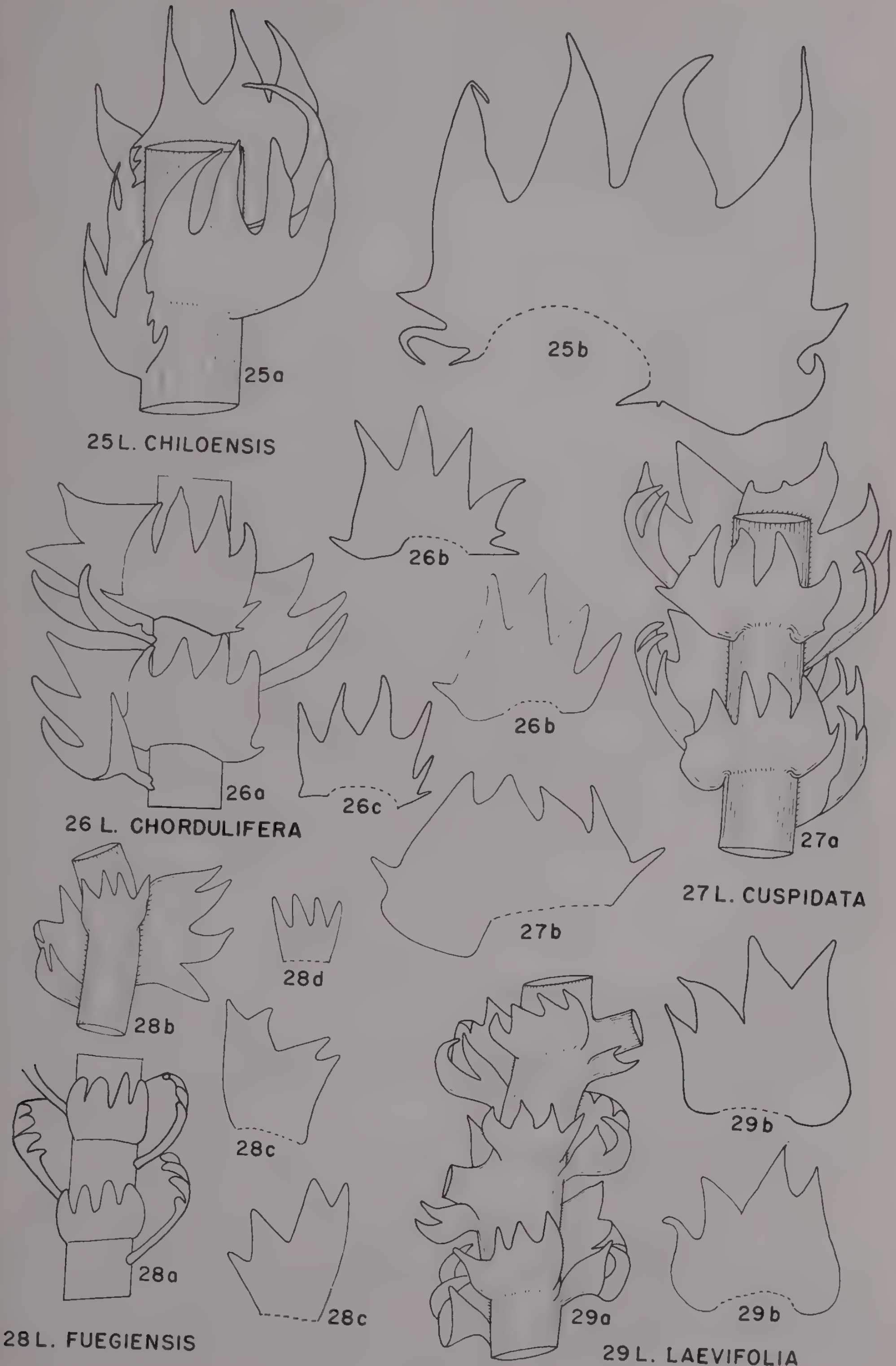
FIG. 26. *L. chordulifera.* 26 a. Stem, ventral view, × 65. 26 b. Leaves, × 57. 26 c. Underleaf, × 57.

FIG. 27. *L. cuspidata.* 27 a. Stem, ventral view, × 45. 27 b. Stem leaf, × 57.

FIG. 28. *L. fuegiensis.* 28 a. Stem, ventral view, × 65. 28 b. Stem, ventral view (*L. halleana*), × 45. 28 c. Leaves, × 57. 28 d. Underleaf, × 57.

FIG. 29. *L. laevifolia.* 29 a. Stem, ventral view, × 40. 29 b. Leaves, × 57.

Drawings, except 26 a and 28 a, after J. Taylor, 1960.


25a
25b
26b
26b
26a
26c
27a
27b
28b
28d
28c
28a
28c
29b
29a
29b

25 L. CHILOENSIS

26 L. CHORDULIFERA

27 L. CUSPIDATA

28 L. FUEGIENSIS

29 L. LAEVIFOLIA

Plate 44

or sometimes entire, the ventral margins entire or toothed, quadrifid to one-half of their length; segments unequal, triangular from a 4- to 10-celled base, the apex a row of two or three cells; leaf-cells of the base of the segment mostly 10–18×18 μ, the walls thickened, the cuticle faintly papillose. Underleaves as broad or broader than the stem, quadrifid to the middle, the segments slender from a 4- to 6-celled base, the tip of two or more cells, the margins of the lamina with usually one sharp tooth on each side. Male inflorescence intercalary on a branch [only one seen], the bracts and bracteoles in four series. Female inflorescence and sporophytes not seen. Pl. 44. Fig. 26, a–c.

Habitat: On logs, tree bases and soil in forests, and on compact mounds in bogs.

JUAN FERNANDEZ: Masatierra, *Skottsberg,* the type of *L. fernandeziensis* (G).

PATAGONIA—TIERRA DEL FUEGO: Chonos Archipelago, *Darwin 461,* (type FH); s.l., *Gay,* Hb Montagne (PC); Valparaiso, without collector, Hb Montagne, as *L. filamentosa minus affine* (PC); Valdivia, *Hahn,* ex Hb Jack, as *L. angulata* (G), *Hahn,* as *L. fernandeziensis* (G); Corral, *Thaxter 20 p.p., 68, 117 p.p., 157 p.p.* (MICH); Río Aysen, *Dusén 83a,* the type of *L. hastata* (G); *Dusén* (C, G); Lake Llanquihue, *Dusén* (G); Lanalhue, *Bro. Claude-Joseph 5972* (US); Pto Bueno, *Dusén* [*44*] (G); Punta Arenas, *Darwin* (G), *Thaxter* 56 (MICH); Magellan Straits, *Nadaud F803725 p.p.* (FH, G), *Papeleur de Tarloo* (G), *Dusén* [*297*] (G), *Warnstorf 9 p.p.* (G); s.l., ex Hb Bescherelle (G-19); Hale Cove, *Dusén,* the type of *L. microscopica* (G); York Bay, *Lechler* (G); w Canal, ex Hb Rom, as *L. halleana* (G); w Patagonia, *Skottsberg* [1901–03] (S-PA), *Skottsberg 559,* the type of *L. effusa* (G), *Skottsberg 887* (G); Pto Churques, *Cunningham 69 p.p.* (G); Pto Famine, Voy. Astrolobe (G): without collector. Hb Montagne (PC); Río Blanco between Fuentes Bulness and Punta Arenas, *C. A. & G. Hässel de Menéndez 798 p.p.* (BA 11139); Fuentes Bulness, *C. A. & G. Hässel de Menéndez 527* (BA 11119). *Fulford 16* (Hb Fulford); bog about 190 km n of Punta Arenas near Hotel Rubens, *Fulford 246, 252, 260, 265, 277, 288, p.p., 289, 290, 291 p.p., 293* (Hb Fulford); Riesco I., Seno Skyring, Punta Leon, *C. A. & G. Hässel de Menéndez 480, 485* (BA 11072, 11077). *Fulford 333, 335, 341 p.p., 344, 353, 356 p.p., 376 p.p.,* (Hb Fulford). Río Azopardo, *Dusén* (G-97), *Halle & Skottsberg* (G), *Dusén* [*83, 98*] (G); s.l., *Dusén* [*405*] (G); Clarence I., Exp. Antarc. belg. *431b;* (BR, G) Desolation I., *Dusén* [*160, 173*] (C, G); Cape Horn, Pto Hapler, *Cunningham 79 p.p.,* ex Hb Kew (G-12); Lapataia, *C. A. & G. Hässel de Menéndez* 717 *p.p.* (BA 11310); Los Cerros, *C. A. & G. Hässel de Menéndez 625 p.p.* (BA 11217); Lago Roca, *C. A. & G. Hässel de Menéndez 807, 813–814 p.p., 818* (BA 11400, 11406, 11411); Lago Cami, *C. A. & G. Hässel de Menéndez 856–57, 862 p.p.* (BA 11449–50, 11455); Ainsworth Bay, *De Gasperi* (FI); Laberinto, I., *De Gasperi* (FI); bahia below Monte Sarmento, *De Gasperi* (FI); Pto Sicurezza, *De Gasperi* (FI). Hermite I., ex Hb Bescherelle, the type of *L. hariotii p.p.* (G); Staten I., *Spegazzini,* "cum Massalonga 104a" (G); Staten I., *Skottsberg* (S-PA); Pto Cook, *Skottsberg* (S-PA).

FALKLAND ISLANDS: Pto Stanley, without collector (G-22); Pto Herrick, *Skottsberg 17* (G); Pto Stanley, *Skottsberg 28,* as *L. pallida* (G-178).

Additional reports include: Chile (Arnell, 1955, Bescherelle & Massalongo, 1889; Evans, 1898; Herzog, 1923, 1939b, 1942, 1943, 1948a, 1954, 1960; Herzog & Schwabe, 1939; Stephani 1900a, 1900b, 1901a, 1901b, 1911; Taylor & Hooker, 1847), Juan Fernandez (Arnell, 1957; Herzog, 1942a; Stephani, 1911), Argentina (Herzog, 1957; Kühnemann, 1949; Muller, 1955), Tierra del Fuego (Massalongo, 1885, 1908, 1927; Stephani, 1901a, 1905a), and the Falkland Islands (Skottsberg, 1913).

27. Lepidozia cuspidata Stephani, Sv. Vet.-akad. Handl. **46**^{9}**:** 61–62. *f. 23, a, b.* 1911; Icon. Hep., *No. 147.*

Plants small greenish-brown to pale brown, in loose mats; stems 3–5 cm long, with leaves to 0.5 mm broad, bi- to sometimes tripinnately branched, lateral branches mostly 2 mm apart, mostly 5 mm long, rarely flagelliform at the tips, the ventral branches not seen. Line of leaf insertion oblique. Stem leaves distant to approximate, spreading-concave with the outer part ascendent, 0.4–0.5 mm long, mostly broader than long, the dorsal margin semicordate and with one to several teeth, the ventral margin with an occasional tooth, quadrifid to one-fourth of their length; segments unequal, triangular from a 6- to 10-celled base, acute; leaf-cells of the base of the segments quadrate, 18–24 μ, the walls thickened, the cuticle smooth. Underleaves nearly as broad as the stem, broader than long, quadrifid to the middle, the segments narrowly triangular from a 3- to 4-celled base, the margins of the lamina convex, bearing several teeth. Female inflorescence occasional, the innermost female bracts orbicular, crenulate-short ciliate above. Perianth to 6 mm long, the mouth contracted, crenulate. Male inflorescence not seen. Pl. 44. Fig. 27, a, b.

Habitat: On logs and tree bases in forests, and over humus mounds in *Sphagnum* bogs.

PATAGONIA—TIERRA DEL FUEGO: w Patagonia, *Skottsberg,* the type (G); Corral, *Dusén* [1897] (S-PA); Punta Arenas, *Thaxter 53, 91 p.p., 100, 102* (MICH); bogs approximately 190 km n of Punta Arenas, near Hotel Ruben, *Fulford 253, 273 p.p., 278, 280 p.p.* (Hb Fulford): Riesco I, Serro Skyring, Punta León, *C. A. & G. Hässel de Menéndez 434, 469* (BA 11026, 11061); Río Azopardo, *Dusén* [1897] (S-PA); estancia El Carmen, *C. A. & G. Hässel de Menéndez 616* (BA 11208); estancia La Ruby, *C. A. & G. Hässel de Menéndez 640* (BA 11232); Lago Roca, *C. A. & G. Hässel de Menéndez 825* (BA 11418); Lago Cami, *C. A. & G. Hässel de Menéndez 873, 876, 893* (BA 11466–69, 11486); Pto Sicurezza, *De Gasperi* (FI); Laberinto I., *De Gasperi* (FI); bahia below Monte Sarmiento, *De Gasperi* (FI). Hoste I., Hardy Peninsula, Bahia Orange, [voyage of the "Yelcho"], *Chelminski 26 p.p., 27 p.p., 30 p.p., 36 p.p.* (Hb Fulford). Staten I., Pto Cook, *Skottsberg* [1903] (S-PA).

The species has also been reported from Patagonia by Arnell (1955) and Herzog (1960).

28. Lepidozia fuegiensis Stephani, Sv. Vet.-akad. Handl. **46^{9}:** 63. *f. 24, f, g.* 1911.

Lepidozia minuta Stephani, Spec. Hep. **3:** 603. 1909; Icon. Hep., *Lepidozia No. 161.* Non *Colenso,* 1886.
Lepidozia magellanica Stephani, Vet.-akad. Handl. **46^{9}:** 64. *f. 24, m, n.* 1911.
Lepidozia halleana Stephani, Sv. Vet.-akad. Handl. **46^{9}:** 64, 66. *f. 24, k, l.* 1911.
Lepidozia parva Stephani, Sv. Vet.-akad. Handl. **46^{9}:** 65, 66. *f. 24, f, g.* 1911.

Plants small, light green to yellowish or brown, in depressed mats or among other bryophytes; stems to 6 cm long, with leaves 0.48–0.8 mm broad, becoming tripinnate, the lateral branches 2–3 mm apart, sometimes becoming flagelliform, 0.5–1.0 cm long; the ventral branches not seen. Line of leaf insertion oblique. Stem leaves small, distant, subquadrate to rectangular, plane to concave with incurved segments, 0.3–0.6 mm long, 0.4–0.6 mm wide at the base, the dorsal margin slightly concave, the ventral margin straight, entire, quadrifid to one-fourth of their length; segments in pairs, triangular from a 2- to 6-celled base, with a tip of one or two cells; leaf-cells at the base of the segment $18–27 \times 18$ μ, the walls scarcely thickened, the trigones small, the cuticle smooth. Underleaves scarcely as broad as the stem, quadrifid to the middle, the segments mostly broad, triangular from a 3- to 4-celled base, ending in a tip one or two cells long, the margins of the lamina without teeth or with an occasional obscure tooth on one or both sides. Sexual branches and sporophytes not seen. Pl. 44. Fig. 28, a–d.

Habitat: Among *Sphagnum* or over rocks, logs, and tree bases.

PATAGONIA—TIERRA DEL FUEGO: Punta Arenas, *Thaxter 91, 102* (MICH); w Patagonia, *Halle 680,* the type of *L. parva* (G-187); w Patagonia, *Skottsberg 537, 538, 638* (G); Aysen Valley, *Dusén,* s.n., *221* (S-PA), *Dusén* (NY); Felix I., *Skottsberg 594,* the type of *L. magellanica* (S-PA); Magellan Straits, *Skottsberg* (G); Jeronimo Canal, *Skottsberg 537* (type G), *538* (G); bogs approximately 190 km n of Punta Arenas, near Hotel Rubens, *Fulford 76, 77, 79 p.p., 80, 81, 85, 92 p.p.* (Hb Fulford), same area, *C. A. & G. Hässel de Menéndez*

553, 557, 573 (BA 11145, 11149, 11165); Río Azopardo, *Dusén 93,* type of *L. minuta* (G-91); Lago Cami, *C. A. & G. Hässel de Menéndez 893 p.p.* (BA 11486); bahia at base of Monte Sarmiento, *De Gasperi* (FI); Pto Sicurezza, *De Gasperi* (FI); "Valle delle Fate," *De Gasperi* (FI); Staten I.: Pto Cook, *Skottsberg* [Exp. 1901–03] (S-PA); Hermite I., *Hariot 177 p.p.,* ex Hb Bescherelle, with the type of *L. hariotii* (G); Navarino I., *Skottsberg* [1901–03] (S-PA); s.l., *Skottsberg* (G).

FALKLAND ISLANDS: Pto Stanley, *Halle 218,* the type of *L. halleana* (G-187), also *Halle 193* (G).

Additional reports include Chile (Arnell, 1955; Herzog, 1954) and Argentina (Kühnemann, 1949).

29. Lepidozia laevifolia Hooker f. & T. Taylor in G. L. & N. Syn. Hep. 208. 1845.

Jungermannia laevifolia Hooker f. & T. Taylor, London Jour. Bot. **3:** 385. 1844.
Mastigophora laevifolia (H. f. & T.) Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Lepidozia minuta Colenso, Trans. N. A. Inst. **18:** 245. 1885.
Lepidozia jacquemontii Stephani. Spec. Hep. **3:** 604. 1909; Icon. Hep., *Lepidozia* No. 158. Non *L. jacquemontii* Stephani, Spec. Hep. **6:** 330. 1922.
Lepidozia viridissima Stephani, Spec. Hep. **3:** 604. 1909; Icon. Hep., *Lepidozia* No. 164.
Lepidozia falklandica Stephani, Sv. Vet.-akad. Handl. **46**^{9}: 64. *f. 24, c, d.* 1911.

Plants of small to medium size, pale to olive-green or brownish, in depressed mats; stems slender, to 3–5 cm or more long, with leaves to 0.8 mm broad, bipinnate, the lateral branches short, rarely flagelliform, 1 mm apart; ventral branches not seen. Line of leaf insertion oblique. Stem and branch leaves distant to imbricate, plane to concave, rounded-rectangular, 0.4–0.5 mm long, 0.2 mm broad at the base, the dorsal margin convex, the ventral margin straight, both without teeth, quadrifid to one-half; segments incurved, broadly triangular, acute from a 4- to 6-celled base; cells of the base of the segment quadrate, 16–18 $\mu \times 18\ \mu$, the wall thickened, the cuticle papillose. Underleaves subquadrate, broader than the stem, squarrose-concave with the segments straight, the margins entire, quadrifid to one-half of their length, the segments acute from a 3- to 5-celled base, the tip of one or two cells. Sexual branches and sporophyte not seen. Pl. 44. Fig. 29, a, b.

Habitat: On logs, soil mats, and tree bases in forests.

PATAGONIA—TIERRA DEL FUEGO: s.l., *Dusén* [*313*], as *L. jacquemontii* (G-20) Aysen Valley, *Dusén* [*313*] (C, G); Valdivia, *Hahn, 13,* ex Hb Jack, as *L. jacquemontii* (G-18), *Hahn 13,* pkts as *L. jacquemontii* and *L. falklandica* (G); Chiloe I., ex Hb Bescherelle, as *L. jacquemontii* (G); Pto Varis, *Fulford 502 p.p., 521 p.p., 523 p.p. 543 p.p.* (Hb Fulford); Riesco I., Punta León, *Fulford 381 p.p.* (Hb Fulford); Sandy Point [Punta Arenas], *Lechler, Pl. Magell.* (S-PA); Magellan Straits, w Channel, without collector (G); Magellan Straits, *Dusén,* type of *L. viridissima* (G-479); Fuentes Bulness, *Fulford 39 p.p.* (Hb Fulford); Pto Gallant, *Jacquemont,* type of *L. jacquemontii* [Stephani, 1909] (G-17); Halt Bay, *Cunningham 13,* as *L. halleana* (G); Estancia Cerros, *C. A. & G. Hässel de Menéndez 609–612, 622, 624* (BA 11201–04, 11214, 11216); Bahia near Monte Sarmiento, *De Gasperi* (FI). Hoste I., Hardy Peninsula, Bahia Orange, [voyage of the "Yelcho"], *Chelminski 26 p.p., 27 p.p., 28 p.p.* (Hb Fulford).

FALKLAND ISLANDS: s.l., *Halle 193* (G); Mt. Adams, *Halle & Skottsberg 192,* the type of *L. falklandia* (G); Pto Stanley, *Skottsberg 28,* as *L. pallida* (G-178).

The species has also been reported from the following localities: Juan Fernandez Island (Arnell, 1957; Herzog, 1942a); Chile-Patagonia (Arnell, 1955, 1956a; Herzog, 1939b, 1943, 1948a, 1957b, 1960; Kühnemann, 1949; Schiffner, 1907; Stephani, 1900a, 1900b, 1911); Staten Island (Massalongo, 1885, 1927); Tierra del Fuego (Massalongo, 1885; Stephani, 1911); Falkland Islands (Herzog, 1948a; Massalongo, 1885; Skottsberg, 1913; Stephani, 1911; Taylor & Hooker, 1847).

This species was first collected in Tasmania by Greville (G) and has a wide Antarctic distribution which includes Chile, Argentina, Falkland Islands, Marion Island, Kerguelen Islands, New South Wales, New Zealand and Campbell Island.

30. Lepidozia alstoni Fulford n. sp.

Caules 3–5 cm longi, luteo-brunnei, pinnati; folia subquadrata uno vel duobus dentibus ad marginem basilarem instructa, quadrifida ad medium, segmentorum marginibus irregularibus, undulatis, cellularum parietibus aequabiliter crassis; amphigastria similia, magna, quadrata, quadrifida ad medium, dente magno ad quemque marginem laminae. Bracteae femineae quadrifidae, segmentorum marginibus integris; perianthii ostium late triangularibus dentibus compositum.

Plants large, yellow-brown becoming darker with age, in tufts or among other bryophytes; stems to 5 cm or more long, with leaves, 0.8–1.2 mm broad, ascendent, pinnate, the lateral branches numerous, sometimes tending to become flagelliform at the tips, the ventral branches leafy or sexual. Line of leaf insertion subtransverse. Stem leaves imbricate, subsymmetric, concave, 0.8–1.3 mm long, more or less quadrate, quadrifid to one-half or more; segments long, lanceolate, the margins irregular (abortive teeth ?), undulate; dorsal margin of the lamina convex, with one or two conspicuous teeth, the ventral margin straight, with one or two teeth; leaf cells at the base of the segment quadrate to rectangular in outline, $26–34 \times 26\ \mu$, the walls equally thickened, the cell lumina angular-rounded, the trigones inconspicuous, the cuticle faintly verruculose. Underleaves similar, nearly as large, subquadrate, symmetric, 0.6–0.9 mm long, with a large tooth near the base on both sides, quadrifid to one-half, the margins of the segments irregular. Female inflorescences one to several on a stem, the bracts and bracteoles in four series, quadrifid, the bracts of the inner series divided to one-third their length, the segments long, undivided. Perianth to 4 mm long, plicate, contracted above, the mouth of short, broadly triangular segments. Male inflorescence and sporophyte not seen. Pl. 45. Fig. 30, a–m.

Habitat: On trees, and in crevices of rocks, at high altitudes.

COLOMBIA: Los Gagues, 10,700 ft, *Alston 7493a* (type BM).
ECUADOR: Pichincha, 15,000 ft, *Bell 408* p.p. (BM).

The species is distinct and readily recognized because of the large size, and brown pigmentation, the long, irregular segments of the leaves and underleaves, the occurrence of teeth or spines on the margins of the lamina of both leaves and underleaves, and the uniformly thickened cell walls.

The size, color and general aspect of the plants suggest the genera *Lepicolea* and *Triandrophyllum.* However, the species is readily separated from *Lepicolea* since in the latter the leaf-cells have large trigones and a coelocaule is formed around the sporophyte. Although the species of *Triandrophyllum* have an incubous leaf arrangement and a leaf-cell pattern similar to that in *L. alstoni,* the line of leaf insertion is strongly oblique and recurved at the dorsal end, the underleaves are bifid or trifid rather than quadrifid, and the female inflorescence is terminal on the stem rather than on a short ventral sexual branch.

Additional species of *Lepidozia* reported from Latin America for which there has been insufficient or no material available.

Lepidozia cupressina β dubia Massalongo, Nuovo Gior. Bot. Ital. **17:** 240. 1885.

Lepidozia densa Herzog, Repert. Sp. Nov. **21:** 26. 1925. *Hoehne,* Brazil.

Lepidozia erronea Herzog, in Skottsberg, Nat. Hist. Juan Fernandez Easter Is. **2:** 725. 1942. *Skottsberg,* Juan Fernandez.

Lepidozia jacquemontii Stephani, Spec. Hep. **6:** 330. 1922. Non *L. jacquemontii* Stephani, Spec. Hep. **3:** 604. 1909. *Skottsberg,* Fretum Magellanicum.

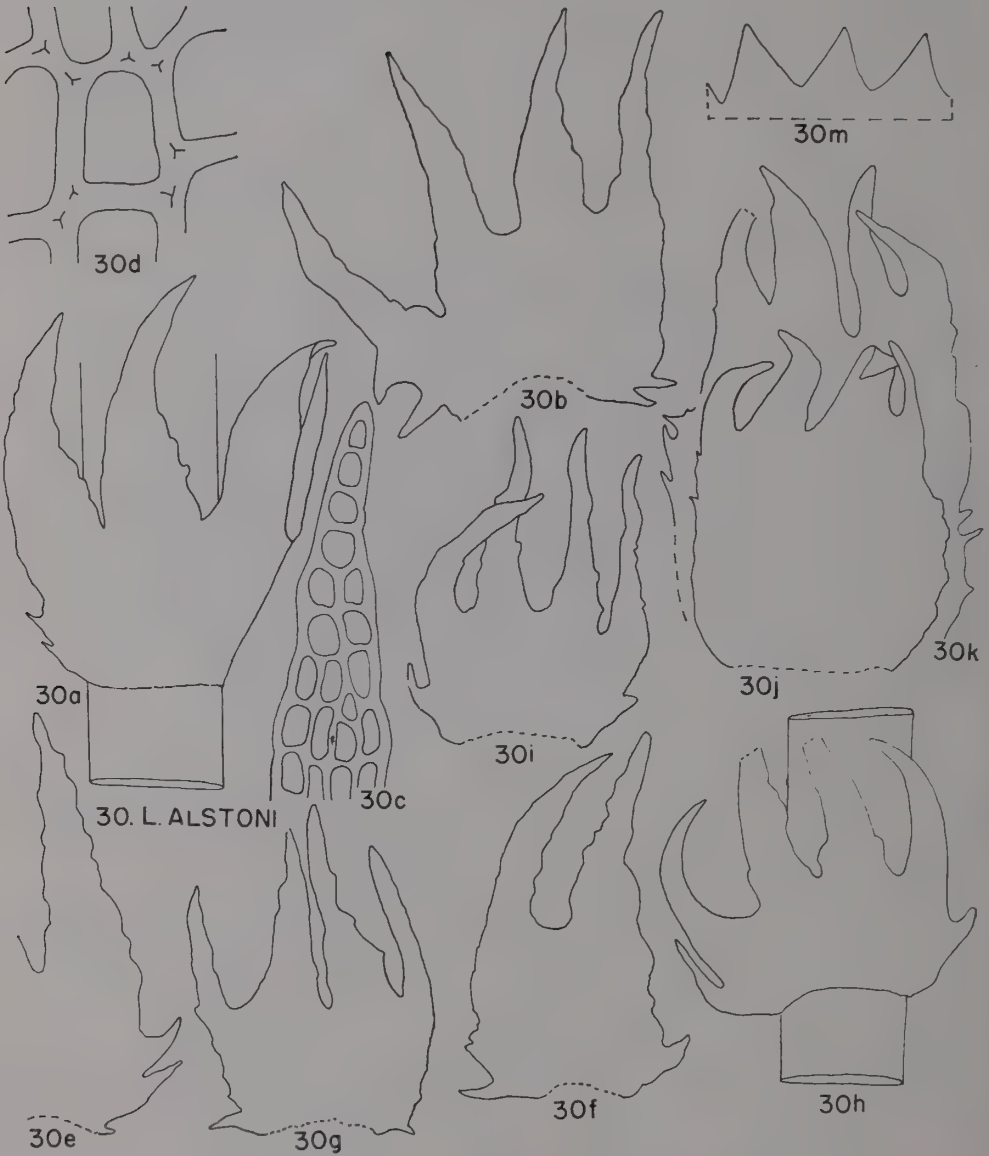


Plate 45

FIG. 30. *Lepidozia alstoni.* 30 a. Stem and leaf, dorso-lateral view, × 75. 30 b. Stem leaf, × 75. 30 c. Cells of the upper part of a segment, × 300. 30 d. Leaf cells from the base of a segment, × 700. 30 e. Dorsal margin of a leaf, × 75. 30 f. Dorsal half-leaf at the base of a branch, × 75. 30 g. Branch leaf, × 75. 30 h. Stem and underleaf, ventral view, × 75. 30 i. Underleaf, × 75. 30 j. Female bract, intermediate series, × 75. 30 k. Female bract, inner series, × 75. 30 m. Portion of perianth mouth (immature), × 75. Drawn from the type.

Lepidozia karstenii v. *hamulispina* Herzog, Hedwigia **74:** 93. 1934. *Tröll,* Bolivia.

Lepidozia pallida Stephani, Spec. Hep. **3:** 604. 1909. *Dusén,* Patagonia. No plants of *Lepidozia* in the type packet.

Lepidozia rufescens Stephani **6:** 340. 1922; Icon. Hep., *Lepidozia No. 31. Herzog,* Bolivia.

Lepidozia serpens Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 364. 1885. *Spruce,* Ecuador. [The material does not agree with the description.]

Lepidozia sprucei Stephani. Icon. Hep., *Lepidozia No. 80.* Nomen nudum.

Lepidozia tunguraguae Stephani, Spec. Hep. **6:** 345. 1922. *Lindig,* Columbia.

Lepidozia truncatella var. *altirimata* Spruce, Mem. Torrey Club **1:** 30. 1890.

Lepidozia urbani Stephani, Icon. Hep., *Lepidozia No. 85/86.* Nomen nudum.

The remainder of the Latin American species of *Lepidozia* have been transferred to other genera.

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Sprucella Stephani, Bot. Jahr. **8:** 92. 1887.

Plants of medium size, loosely branched; lateral branches leafy, sometimes becoming flagelliform in the outer part, of the *Frullania* type with the dorsal half-leaf ovate, the ventral branches axillary intercalary, leafy or flagelliform, or shorter, sexual; stem in transverse section with a unistratose cortical layer of 18–26 cells, with some cells larger than those of the medulla. Rhizoids in matted tufts from near the base of the underleaves, and from the base of a female inflorescence. Line of leaf insertion oblique, almost longitudinal, the leaves incubous. Leaves appearing decurrent, small, subquadrate to rectangular, the ventral margin the longer, tridentate with broadly triangular teeth. Underleaves subrectangular to cuneate, quadrifid to the middle. Branch leaves mostly bifid, long, narrow. Plants dioicous; sexual branches ventral, axillary, intercalary. Male bracts and bracteoles in to 20 or more series, the bracts concave, monandrous; antheridia globose, the stalk of one row of cells. Female inflorescence without innovations, the bracts and bracteoles similar, different from the leaves, in three or four series, the inner series quadrifid to four-fifths of their length into long narrowly triangular segments. Perianth fusiform, trigonous above, of three layers of cells below, the mouth contracted, ciliate. In transverse section the seta with an outer layer of eight large cells surrounding smaller cells.

Type species: *Lepidozia succida* Mitten, 1860.

The genus with two species is known only from Africa.

Reference: Fulford & J. Taylor, 1959a.

Neolepidozia Fulford & J. Taylor, Brittonia **11:** 81–82. *f. 28–41.* 1959.

Lepidozia auctt. p.p.
Telaranea subg. *Neolepidozia* Schuster, Jour. Hattori Bot. Lab. **26:** 254. 1963.

Plants small, light green to olive-green or reddish; stems pinnate to bipinnate, the lateral branches leafy, of the *Frullania* type, subtended by a bifid dorsal half-leaf, often becoming flagelliform in the outer part, the ventral branches intercalary, in the axils of the underleaves, long flagelliform or short sexual; stem in transverse section elliptical, with a unistratose cortical layer of mostly twelve large thin-walled cells surrounding a medulla of numerous thin-walled cells. Rhizoids colorless, from cells of the underleaves, the scales of flagelliform branches, and the base of the female branch. Line of leaf insertion oblique, almost longitudinal, the leaves incubous. Leaves symmetric to asymmetric, subquadrate, subrectangular or cuneate in outline, divided above into four triangular segments, only three on the branch leaves, the margins entire. Underleaves transversely inserted, similar to the leaves but smaller. Plants dioicous, the short sexual branches ventral intercalary, or the male inflorescence intercalary on a stem or branch; male bracts and bracteoles in to ten series, the bracts monandrous, concave, bifid above, the bracteoles smaller, plane; antheridia subglobose. Female branches very short, the bracts and bracteoles similar, different from the leaves and underleaves, in three or four series, broadly ovate, divided above into three or four short segments, the margins with occasional short teeth. Perianth 3–4 mm long, 4 or 5 layers of cells below, one-layered above, cylindrical and with three broad keels below, contracted above, the mouth crenulate. Capsule wall of three layers of cells, the seta with 8 large outer cells surrounding 16 inner cells.

Type species: *Jungermannia capilligera* Schwaegrichen.

This small genus with an Antarctic distribution is best characterized by its green color and small size, the oblique, nearly longitudinal line of leaf insertion, a cortex of one layer of twelve longitudinal rows of large thin-walled cells surrounding the medulla, and the small, triangular segments of the leaves and underleaves.

Key To The Species

1. Leaves cuneate, quadrifid to one-half of their length; segments widely divergent; leaf-cells in many rows except for the 8-rowed base. 1. *N. capilligera.*
1. Leaves rectangular, quadrifid to one-fourth or one-third of their length; segments straight or only slightly spreading.
  2. Segments of the leaves two or three cells wide at the base, mostly five or six cells long; leaf-cells in more than eight longitudinal rows. 2. *N. seriatitexta.*
  2. Segments of the leaves two cells wide at the base, three cells long; leaf-cells in eight longitudinal rows. 3. *N. oligophylla.*

1. Neolepidozia capilligera (Schwaegrichen) Fulford & J. Taylor, Brittonia **11:** 84. *f. 28.* 1959.

Jungermannia capilligera Schwaegrichen, Prodromus 21. 1814.
Jungermannia tridactylis Lehmann & Lindenberg in Lehmann. Pug. Pl. **4:** 41. 1832.
Lepidozia capilligera Lindenberg in G. L. & N. Syn. Hep. 204. 1845.
Mastigophora capilligera Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.

Plants small, olive-brown, in tufts or mats or among other bryophytes; stems to 2 cm long, regularly pinnate, the lateral branches becoming flagelliform at the tips, the ventral branches long flagelliform; in transverse section the stem uniformly yellow-brown, with a cortical layer of 12 large cells, surrounding the medulla of many smaller cells with thicker walls and large trigones. Line of leaf insertion oblique, nearly longitudinal, the leaves incubous. Leaves distant to subimbricate, cuneate, quadrifid to the middle; segments two, three or even four cells wide at the base, five to seven cells long, ending in a uniseriate tip of two or three cells; lamina five or six rows of cells high, twelve to sixteen cells wide below the segments, eight cells wide at the base, attached to four longitudinal rows of stem cells; leaf-cells rectangular in outline at the base of a segment averaging 36×18 μ, the walls uniformly thin, the cuticle smooth to faintly verruculose. Underleaves smaller, cuneate, quadrifid to one-half of their length, the segments usually uniseriate from a 2- to 3-celled base. Male and female inflorescences and sporophytes not seen. Pl. 46. Fig. 1, a–c.

The species is known from Campbell Island, Tasmania, New Zealand and Australia. The Latin American reports include West Patagonia (Stephani, 1900a) and Magellan Straits and Tierra del Fuego (Massalongo, 1885): I have seen no plants from these areas.

2. Neolepidozia seriatitexta (Stephani) Fulford, comb. nov.

Lepidozia seriatitexta Stephani, Bihang. Sv. Vet.-akad. Handl. III. **26**^{6}: 53. 1900; Icon. Hep., *Lepidozia No. 141* [not from the type.]
Lepidozia husnoti Stephani, Spec. Hep. **6**: 329. 1924; Icon. Hep., *Lepidozia No. 157.*
Neolepidozia husnoti (Stephani) Fulford & J. Taylor, Brittonia **11**: 85. *f. 29.* 1959.

Plants small, in light green to whitish tufts or mats, or among other bryophytes; stems 3–5 cm long, with leaves to 0.8 mm broad, abundantly bi-tripinnately branched, the lateral branches to 1 cm long, much branched, 3 mm apart, rarely becoming flagelliform above, the ventral branches long, flagelliform. Stem in transverse section of twelve large cortical cells surrounding the medulla of many smaller cells. Line of leaf insertion oblique, nearly longitudinal, the leaves incubous. Leaves approximate to imbricate, patent, rectangular with the dorsal margin slightly longer, quadrifid to one-third of their length; segments lanceolate from a 2- or rarely 3-celled base, five or six cells long; leaf cells below the segments averaging 50×40 μ, the walls uniformly thickened, the cuticle faintly verruculose. Underleaves similar, slightly smaller, quadrifid to one-third of their length, the segments two or three cells broad below and ending in a uniseriate tip of two cells. Male inflorescence catkin-like, the concave bracts and plane bracteoles in three or four series, the inner series broadly ovate, the apex of three, rarely four, short segments, the margins with occasional teeth. Perianth to 6 mm long, with three broad keels below, four or five layers of cells below, 1-layered above, the mouth contracted, crenulate. Pl. 46. Fig. 2, a–h.

JUAN FERNANDEZ: s.l., *Bertero,* Hb Montagne (PC).

PATAGONIA—TIERRA DEL FUEGO: Guaitecas I., *Dusén 396* (UPS); Chile, s.l., *Dusén* (G); Patagonia, s.l., *Dusén* (G); Pto Puyuhuapi, *Schwabe 41 p.p.* (Hb Herzog); cerro Tesaro Massiv, *Schwabe 41a p.p.* (Hb Herzog); Newton I., *Dusén 21,* (type G, isotype K); Pto Ochse, *Dusén* (G); Magellan Straits, *Hb Husnot no. 11 p.p.,* type of *L. husnoti* (G); Island Harber, *Cunningham 36 p.p.,* ex Hb Kew (G); Desolation I., Pto Angosta, *Dusén 272* (UPS).

SOUTH GEORGIA: s.l., Skottsberg (as *L. oligophylla*) (G-169).

The species has also been reported from Patagonia by Herzog (1960) and Stephani (1901b, 1911).

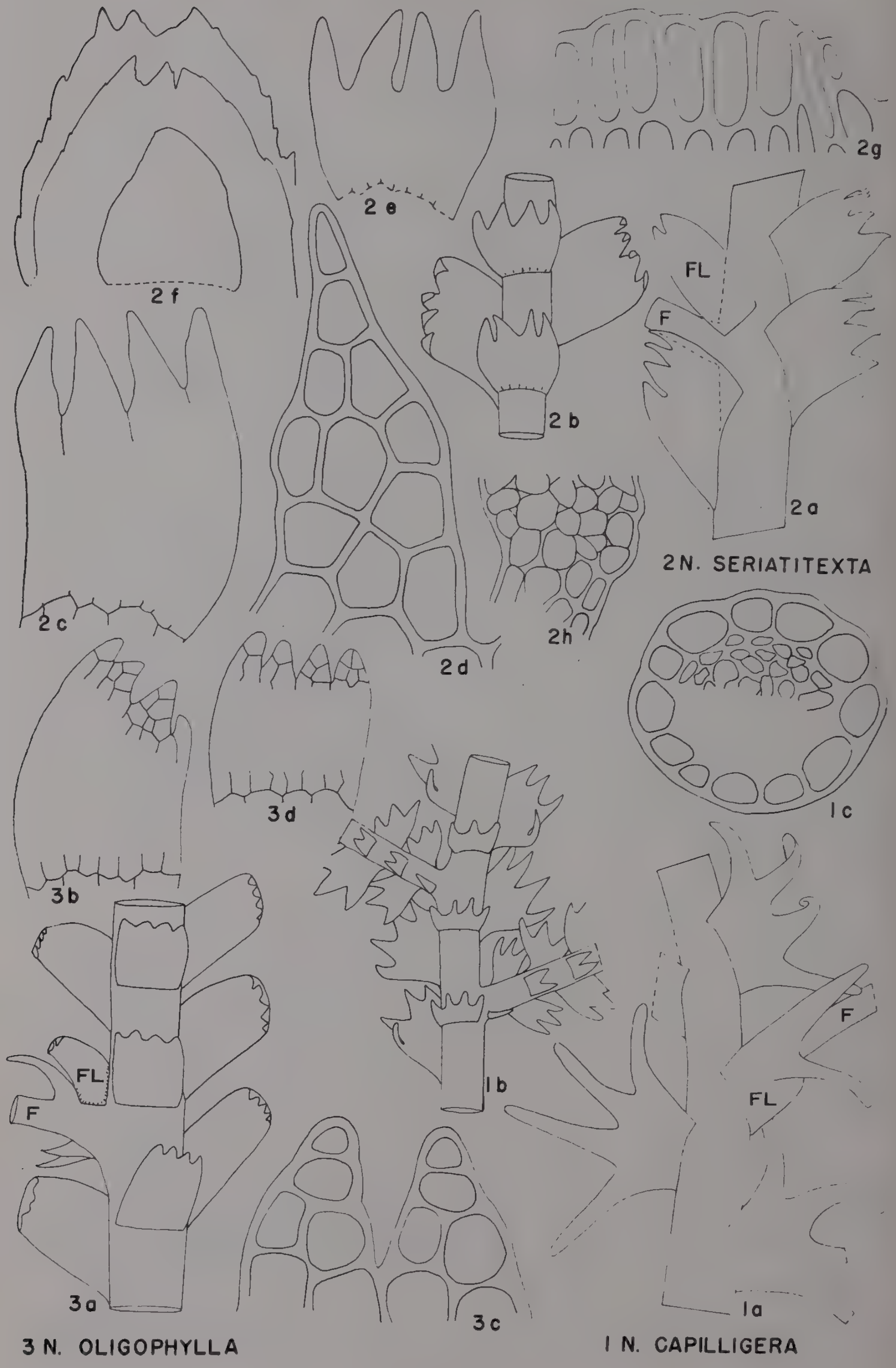

2 e
2g
2 f
FL
F
2 b
2 a
2 N. SERIATITEXTA
2 c
2 d
2 h
1 c
3 b
3 d
1 b
F
FL
FL
F
3 a
3 c
1 a
3 N. OLIGOPHYLLA
1 N. CAPILLIGERA

Plate 46

3. Neolepidozia oligophylla (Lehmann & Lindberg) Fulford & J. Taylor, Brittonia **11:** 84. 1959.

Jungermannia oligophylla Lehmann & Lindenberg in Lehmann. Pug. Pl. **6:** 26. 1834.
Lepidozia oligophylla Lindenberg in G. L. & N. Syn. Hep. 210. 1845.
Mastigophora oligophylla Trevisan, Mem. Ist. Lomb. III. **4:** 415. 1877.

Plants small, whitish-green to deeply pigmented with red-brown, often etiolated, in deep tufts or among other bryophytes; stems 2–6 cm long, with leaves to 0.5 mm broad, slender, irregularly bipinnately branched, the lateral branches few to many, long, often branched, some becoming flagelliform in the outer part, ventral intercalary branches long, slender, flagelliform, rarely leafy; stem in transverse section averaging 0.4 mm across, the unistratose cortical layer of 12 large, thin-walled cells $30 \times 70\ \mu$, the cells of the medulla under $45\ \mu$, the walls thin with very small trigones. Line of leaf insertion oblique, the leaves incubous. Leaves distant to approximate, patent, rectangular in outline, to 0.5 mm long, 0.35 mm wide, the dorsal margin curved, longer than the ventral margin, the cells in eight longitudinal rows from the base, the apex quadrifid; segments (teeth) only two or three cells long, two cells wide at the base; leaf-cells $40–45 \times 30\ \mu$, the walls uniformly thickened, the cuticle faintly verruculose. Underleaves similar to the leaves, large, only slightly shorter, appressed or spreading, of eight rows of cells, the segments obtuse, the base of two cells. Male inflorescence on a short ventral sexual branch, catkin-like, the bracts and bracteoles in few series. Female inflorescence and sporophyte not seen. Pl. 46. Fig. 3, a–d.

Habitat: Among *Sphagnum*, or in tufts in wet places.

PATAGONIA—TIERRA DEL FUEGO: Magellan Straits, "with *Warnstorf* B" (G), s.l., *Skottsberg* (G); Mayne Harbor, *Cunningham 169* (G-171); Pto Eden, *Gardiner*, ex Bescherelle (G-107); Patagonia, s.l., *Dusén 68* (G); Desolation I., *Dusén 200* (G-172); Pto Angosta, *Dusén* (with *Micrisophylla cucullifolia*) (S-PA); Fuegia, s.l., *Dusén 200* (G); Río Azopardo, *Dusén 36, 87, 120* (G), *Dusén* (C); Fjordo Finlandia, *Roivainen* (S-PA); Staten I., ex Hb. Lindenberg, (type G); the same, ex Hb Lehmann, Hb Montagne (type PC), the same (G-168); Bay Ainsworth, *de Gasperi* (FI).

The species is also reported from Patagonia (Bescherelle & Massalongo, 1889; Kühnemann, 1949; Schiffner, 1889; Stephani, 1901a, 1905a, 1911), Tierra del Fuego (Massalongo, 1885) and Clarence Island (Stephani, 1901b).

The packet of the original collection of the manuscript (?) species *Lepidozia Schwabei* Herzog in the Herzog Herbarium contains both *N. seriatexta* and *N. oligophylla*.

Plate 46

FIG. 1. *Neolepidozia capilligera*. 1 a. Stem, dorsal view, × 25; F, branch of the *Frullania* type; FL, bifid dorsal half-leaf with this branch. 1 b. Stem (small), ventral view, × 40. 1 c. Transverse section of a stem, × 180.

FIG. 2. *N. seriatitexta*. 2 a. Stem, dorsal view, × 25; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch. 2 b. Stem, ventral view, × 25. 2 c. Leaf, × 65. 2 d. Leaf segment, × 275. 2 e. Underleaf, × 65. 2 f. Female bracts of the outer, intermediate and inner series, × 65. 2 g. Cells of the perianth mouth, × 400. 2 h. Transverse section of a portion of the lower part of the perianth, × 135.

FIG. 3. *N. oligophylla*. 3 a. Stem, ventral view, × 40; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch. 3 b. Leaf, × 65. 3 c. Two leaf segments, × 275. 3 d. Underleaf, × 65.

All figures drawn from the types.

Micrisophylla Fulford, Brittonia **14:** 124. 1962.

Lepidozia auctt. p.p.
Isotachis auctt. p.p.

Plants of small to medium size, erect or ascending; stems slender, long, irregularly branched, the lateral branches on one side of the stem of the *Frullania* type, with the usually bifid half-leaf dorsal, and on the other side, of the *Microlepidozia* type with the bifid half-leaf ventral; ventral branches intercalary axillary, leafy, or microphyllous to flagelliform with scale-like leaves, or short sexual, or very pale and enlarged and turgid, or as very long, simple or branched stolons with three rows of tiny scales and tufts of colorless rhizoid. Stem in transverse section with a unistratose cortical layer of about 12 cells (18 or 24 cells in *M. cucullifolia*), larger and with thicker walls than the cells of the medulla. Rhizoids from the scale-leaves of flagelliform branches or the leaves of the stolons. Line of leaf insertion transverse. Leaves and underleaves symmetric or nearly so, subquadrate to cuneate in outline, quadrifid to one-half of their length; segments long, triangular, the cells quadrate to rectangular in outline, the walls uniformly thickened. Plants dioicous; male inflorescence on a short ventral sexual branch or terminal, becoming intercalary on a longer leafy branch, the bracts and bracteoles in five to ten series; antheridia one or two in the axils of the bracts; female inflorescence more or less trigonous, terminal on the main stem, a lateral branch, a long leafy ventral branch, a pale, enlarged, turgid ventral branch, or a short ventral sexual branch, the stem below the perianth often becoming enlarged, and turgid, for some distance; bracts and bracteoles similar, different from the leaves and underleaves, in three or four series, more or less keeled. Perianth 3–4 mm long, cylindrical below, contracted and three-keeled above. Shoot/sporophyte relationship a shoot-calyptra. Mature sporophyte not seen.

Type species: *Lepidozia setiformis* De Notaris.

The genus has several primitive or at least unspecialized characters. The stems are erect, radially symmetric or nearly so, while in most of the other genera of the family there is a considerable difference in size and often in form between the leaves and underleaves. The position of the female inflorescence varies even on one stem, while in most of the genera it is restricted to a short ventral, axillary intercalary sexual branch. The genus has an Antarctic distribution.

Key to the Species

1. Bases of the leaf segments five to ten cells across.
  2. Leaves erect-spreading, the segments only slightly incurved; stem with a layer of 12 large cortical cells. 1. *M. setiformis.*
  2. Leaves deeply concave, the segments strongly incurved; stems with a layer of 20–24 large cortical cells. 4. *M. cucullifolia.*

1. Bases of the leaf segments mostly four cells across.
  2. Cells of the leaf segments mostly $18 \times 18\ \mu$. 2. *M. saddlensis.*
  2. Cells of the leaf segments mostly $30\text{–}36\ \mu \times 18\text{–}22\ \mu$. 3. *M. mollis.*

1. **Micrisophylla setiformis** (De Notaris) Fulford, Brittonia **14:** 127. *f. 66–82.* 1962.

Lepidozia setiformis De Notaris, Mem. Real. Acad. Torino **16:** 225. *f. 13.* 1857.
Mastigophora setiformis, Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Lepidozia obscura Ångström ex Stephani, Spec. Hep. **3:** 602. 1909; Icon. Hep., *Lepidozia No. 137.*

Lepidozia fusca Stephani, Sv. Vet.-akad. Handl. **46^9**: 64. *f. 24, h–i.* 1911.
Lepidozia cunninghamii Stephani, Spec. Hep. **6**: 322. 1922; Icon. Hep., *Lepidozia No. 146.*

Plants long, slender, deep brown, in tufts or among other bryophytes; stems more or less erect, radial, to 5 cm long, with leaves to 0.65 mm broad, irregularly branched and with long brown stolons; lateral branches leafy, long, branched; ventral branches leafy, or flagelliform, or long brown, stolon-like, or enlarged, turgid and lighter in color with small leaves and long internodes and eventually bearing a female inflorescence; stems in transverse section with about 12 large cortical cells with thick walls surrounding the medulla of smaller, thinner-walled cells with trigones. Line of leaf insertion transverse. Leaves and underleaves alike, distant to approximate, erect-spreading, more or less concave, cuneate, to 5 mm long, 5 mm wide at the middle, the margins of the lamina entire or with a small tooth near the base, quadrifid to one-half of their length; segments divergent to somewhat incurved, six to eight, sometimes to ten cells wide at the base, triangular; leaf-cells at the base of the segments averaging 18 × 18 μ, the walls uniformly thickened, the trigones inconspicuous, the cuticle verruculose. Plants dioicous. Male inflorescence on a short ventral sexual branch or terminal or becoming intercalary on a longer ventral branch, the bracts and bracteoles in five to ten series, the bracts concave, bifid or trifid, the bracteoles plane, bifid; antheridia one or two in the axils of the bracts. Female inflorescence (only one) terminal on a ventral leafy branch, the stem below the inflorescence enlarged, turgid, with small, distant leaves and underleaves, the bracts and bracteoles faintly keeled, the outer series lobed above, the inner series broadly rounded. Perianth and sporophyte not seen. Pl. 47. Fig. 1, a–f.

Habitat: Abundant over moist rocks, in crevices and among *Sphagnum* in bogs and wet thickets in Patagonia-Tierra del Fuego.

PATAGONIA—TIERRA DEL FUEGO: Valparaiso, *Niger,* the type [not seen]. Skyring, Pto Pinto. *Halle & Skottsberg,* [1907–09] *170,* the type of *L. fusca* (type G-763, isotype S-PA-107); Magellan Straits; Grappler, *Husnot no. 41 p.p.*♂ (G-337 bis); Halt Bay, *Cunningham 95* (G); s.l., *Andersson,* ex Hb Stockholm, the type of *L. obscura* (G); Pto Hapler, *Cunningham, inter no. 174,* ex Hb Kew, the type of *L. cunninghamii* (G-220); Clarence I., *Roivainen* (S-PA); Desolation I., Pto Angosta. *Dusén 206* (S-PA, NY), *Dusén* (G), s.n., Hb H. Möller, without collector (♀) (S-PA), *Dusén,* (S-PA), ex Uppsala Bot. Hb. *Dusén 175* p.p. (G); Fuegia. *Dusén 206* (G-336,-337); Río Azopardo, *Dusén, 206* (S-PA); Staten I., *Spegazzini,* Hb Massalongo 115^2, (neotype G-334), Pto Cook, *Skottsberg* [1901–02] (S-PA).

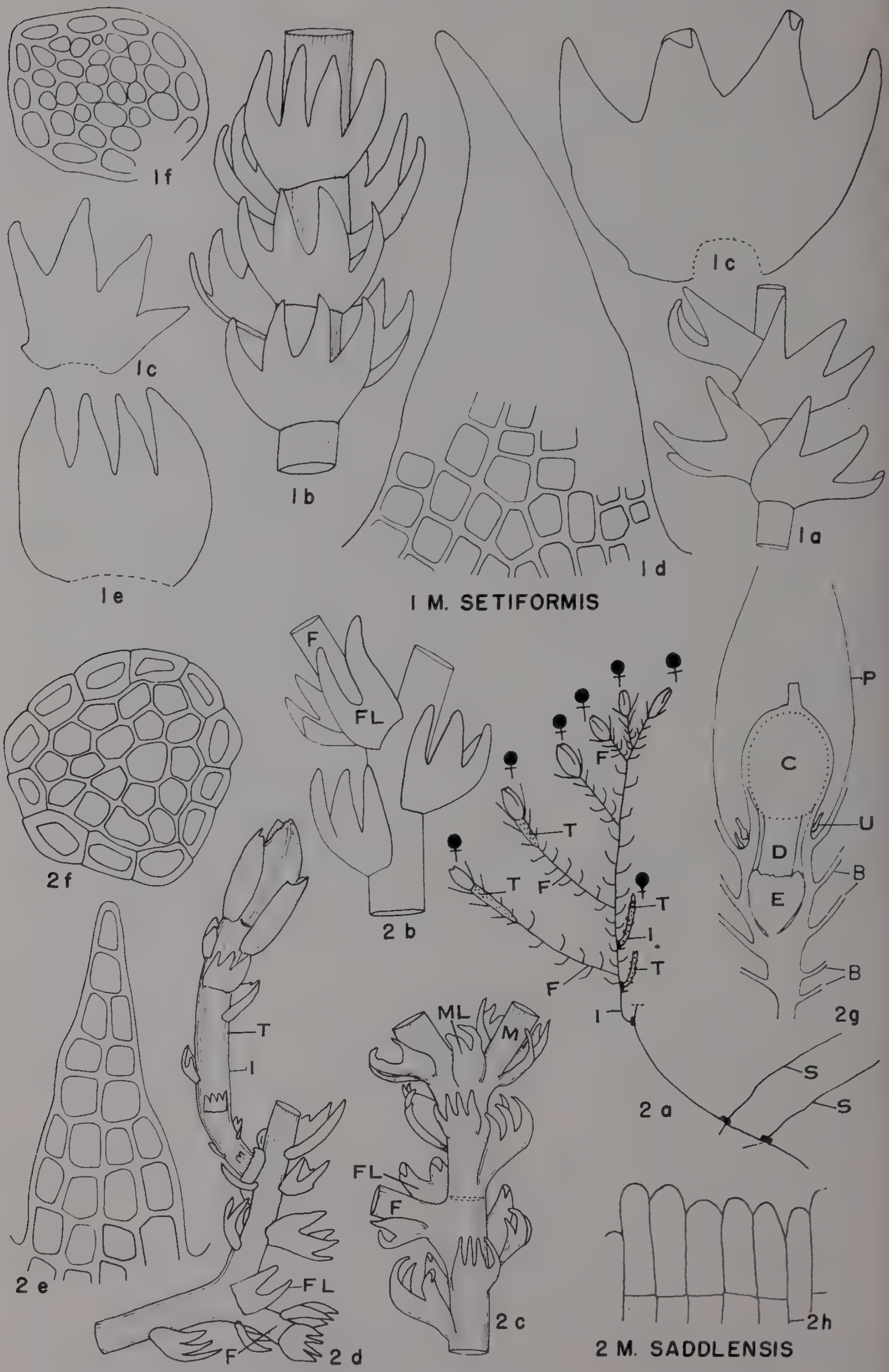
The species has also been reported in the following areas: Argentina (Kühnemann, 1949, Stephani, 1900b), Patagonia (Stephani, 1900a, 1900b, 1901a), Staten and Navarino Islands (Massalongo, 1885, 1927), and Tierra del Fuego (Stephani, 1901a).

The species also occurs in Tasmania; Sandfly Road near Ludbergs, *Weymouth, Hb Levier 1525* (G-335). It is another of the ever increasing group of plants with an Antarctic distribution.

2. **Micrisophylla saddlensis** (Bescherelle & Massalongo) Fulford, Brittonia **14:** 128. *f. 83–102.* 1962.

Lepidozia senlensis Bescherelle & Massalongo, Bull. Mens. Soc. Linn. Paris **1** (No. 79): 637. 1886.
Lepidozia saddlensis Bescherelle & Massalongo, (Separate from) Bull. Soc. Mens. Linn. Paris **1** (No. 79–80): 8. 1886. [Not a reprint.]
Lepidozia diversifolia Stephani, Sv. Vet.-akad. Handl. **46^9**: 62. *f. 23, c–e.* 1911; Icon. Hep., *Lepidozia No. 149.*

Plants filiform, dark brown to blackish, in tufts or among other bryophytes; stems slender, more or less erect, radial, to 3 cm long, with leaves to 0.32 mm


1f
1b
1c
1c
1e
1d
1a
1 M. SETIFORMIS
2f
F
FL
2b
P
C
U
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B
E
B
2g
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F
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2a
S
S
2e
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I
ML
M
FL
F
FL
F
2d
2c
2h
2 M. SADDLENSIS

Plate 47

broad, irregularly branched and bearing long blackish stolons; lateral branches long, leafy, the ventral branches intercalary, long leafy and branched, or long flagelliform, or long stolon-like, or lighter in color, enlarged and turgid, with small leaves and long internodes, and eventually bearing a female inflorescence, or short sexual; stems in transverse section of a single layer of 12 larger cortical cells with thicker walls, surrounding the medulla. Line of leaf insertion transverse. Leaves and underleaves alike, distant to approximate, symmetric squarrose-ascendent, incurved above, to 0.36 mm long, 0.27 mm wide at the middle, cuneate, the margins of the lamina entire, quadrifid to one-half their length; segments triangular from a mostly 4-celled base, six to eight cells long, the tip a row of two cells; leaf-cells at the base of the segment $18 \times 18\ \mu$, the walls thickened, the trigones obscure, the cuticle faintly verruculose. Plants dioicous. Male inflorescence on a short ventral sexual branch or terminal on a longer branch, the bracts and bracteoles in three to six series, the bracts mostly trifid, concave, with a toothed margin, the bracteoles plane, bifid; antheridia one or two in the axils of the bracts. Female inflorescence on a short sexual branch, a longer leafy or flagelliform ventral branch, or a lateral branch of the stem with or without an enlarged turgid axis below, or terminal on an enlarged turgid ventral branch; bracts and bracteoles in three to four series, faintly keeled, the outer series quadrifid above, the innermost series broadly ovate with scattered marginal teeth and lobes, the cells thin-walled. Perianth to 3 mm long cylindrical below, contracted and 3-keeled above, the mouth crenulate. Mature sporophyte not seen. Pl. 47. Fig. 2, a–h.

Habitat: Abundant on decayed logs, soggy ground, and over *Sphagnum* and other bryophytes, in bogs and wet thickets.

PATAGONIA—TIERRA DEL FUEGO: Guaitecas I., *Dusén* (C, G-5427, 5428, G, K, NY, S-PA), *Dusén 386* (G-177, S-PA), Guaitecas I., Melinca, *Halle* [1907–08] (S-PA), *Skottsberg & Halle* [1907–08], the type of *L. diversifolia* (G); Patagonia, *Dusén 386 p.p.* (G-5426); Saddle I., *Hariot 166*, (type PC, isotype G); Hoste I., Hardy Peninsula, Bahia Orange, [voyage of the "Yelcho"], *Chelminski 15* (Hb Fulford).

TRISTAN DA CUNHA: *Christophersen & Meyland 1080, 1088, 1121* (1938) (S-PA).

There are additional reports of the species from Patagonia (Schiffner, 1889; Stephani, 1900a, 1900b, 1901a, 1911), Tierra del Fuego (Bescherelle & Massalongo, 1889; Gola, 1923 (= *Lepidozia*); Stephani, 1901a), and the Falkland Islands (Skottsberg, 1913; Stephani, 1905a).

3. **Micrisophylla mollis** (Stephani) Fulford, Brittonia **14:** 131. *f. 103–114.* 1962.

Lepidozia mollis Stephani, Spec. Hep. **3:** 601. 1909; Icon. Hep., *Lepidozia No. 136/137.*

Plate 47

Fig. 1. *Micrisophylla setiformis.* 1 a. Stem, dorsal view, × 25. 1 b. Stem, ventral view, × 40. 1 c. Leaves, × 80. 1 d. Segment of a leaf, × 350. 1 e. Underleaf, × 80. 1 f. Transverse section of the stem, × 175.

Fig. 2. *M. saddlensis.* 2 a. Growth habit of a plant showing the positions of the female inflorescences, ♀; F, branch of the *Frullania* type; I, ventral axillary intercalary branch; S, stolon; T, enlarged, turgid axis below some of the inflorescences, or as a ventral branch. 2 b. Stem, dorsal view, × 85; F, branch of the *Frullania* type; Fl, dorsal half-leaf with this branch. 2 c. Stem, ventral view, × 60; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 2 d. Stem with, F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch; T, I, a turgid, ventral intercalary branch with a basal collar and at the tip, a female inflorescence. 2 e. Leaf segment, × 350 2 f. Transverse section of a stem, × 350. 2 g. Diagrammatic longitudinal section through a female inflorescence and a young sporophyte; B, female bracts (four series; C, capsule; D, seta; E, foot; P, perianth; U, unfertilized archegonium. 2 h. Portion of the mouth of the perianth, × 350.

Drawings after Fulford, 1962.

Plants small, dark brown with greenish to light brown tips, in tufts or among other bryophytes; stems slender, more or less erect, radial, 2–4 cm long, with leaves 0.6–0.9 mm broad, irregularly branched and bearing long brown to colorless stolons; lateral branches long, leafy, the ventral branches intercalary, long leafy or flagelliform, or long brown or colorless stolon-like, or enlarged turgid, lighter in color and bearing a female inflorescence, or short sexual; stem in transverse section of a single layer of 12 larger, thick-walled cortical cells, surrounding the medulla of smaller cells. Line of leaf insertion transverse. Leaves and underleaves alike, distant to approximate erect-spreading, 0.42–0.48 mm long, 0.36 mm wide at the middle, the margins of the lamina entire, quadrifid to one-half or two-thirds of their length; segments straight, long, divergent, lanceolate, four cells wide at the base; cells at the base of the segments 27–36 × 18–22 μ, the walls uniformly thickened the trigones inconspicuous, the cuticle faintly verruculose. Plants dioicous. Male inflorescence on a short ventral sexual branch, the bracts and bracteoles in five or more series, the bracts concave, the bracteoles plane; antheridia one or two in the axils of the bracts. Female inflorescence terminal on a long flagelliform branch ending in an enlarged turgid tip, the bracts in three series, quadrate to broadly orbicular in outline, the apical portion variously incised, with an occasional marginal tooth. Perianth mouth (immature) undivided, entire. Sporophyte not seen. Pl. 48. Fig. 3, a–g.

Habitat: Decayed logs, over rocks and mixed with other bryophytes in woods.

PATAGONIA—TIERRA DEL FUEGO: Pto Bueno, *Dusén* (type G-96), *Dusén 43* (G, S-PA), *Dusén, s.n.,* (K, NY); s.l., ex Hb Bescherelle (G); Río Azopardo, *Dusén* (G-97); Hoste I., *Spegazzini 201* (as *L. capillaris*) (G); Basket I., *Spegazzini* (G-98).

4. **Micrisophylla cucullifolia** (Stephani) Fulford, Brittonia **14:** 133. *f. 115–131.* 1962.

Lepidozia cucullifolia Stephani, Bihang, Sv. Vet.-akad. Handl. III. **26^6:** 51. 1900; Icon. Hep., *Lepidozia No. 133.*
Isotachis symmetrica Stephani, Spec. Hep. **3:** 661. 1909; Icon. Hep., *Isotachis No. 28.*

Plants long, flaccid, whitish-green to greenish brown or dark brown, in tufts or mats or among other bryophytes; stems slender, more or less erect, radial, to 3 cm or more long, with leaves 0.32–0.48 mm broad, irregularly sparingly to abundantly branched and with long light or dark colored stolons; lateral branches leafy, long, scarce, ventral branches intercalary, numerous, long, leafy or flagelliform, or long, light or dark colored, stolon-like, or short-sexual; stem in transverse section with a cortical layer of 20–24 larger cells with thicker walls and deeper pigmentation surrounding the medulla, the cortical cells smaller in lighter colored, spongy stems. Line of leaf insertion transverse. Leaves and underleaves alike, distant to imbricate, spreading-concave, incurved above, subquadrate in outline, averaging 0.5 mm long, 0.56 mm wide, the base curved,

Plate 48

FIG. 3. *Micrisophylla mollis.* 3 a. Stem, ventral view, × 80. 3 b. Leaf, × 80. 3 c. Leaf segment, × 350. 3 d. Small leaf from a turgid axis, × 80. 3 e. Transverse section of a stem, × 200. 3 f. Female bracts of the outer, intermediate, and inner series, × 40. 3 g. Portion of the mouth of an undeveloped perianth, × 80.

FIG. 4. *M. cucullifolia.* 4 a. Stem, ventral view, × 85. 4 b. Leaves, × 80. 4 c. Leaf segment, × 350. 4 d. Very slender stem, ventral view, × 85. 4 e. Transverse section of a stem, × 200. 4 f. Female bracts of the outer, intermediate and inner series, × 50. 4 g. Cells of the mouth of the perianth, × 350. Drawings after Fulford, 1962.

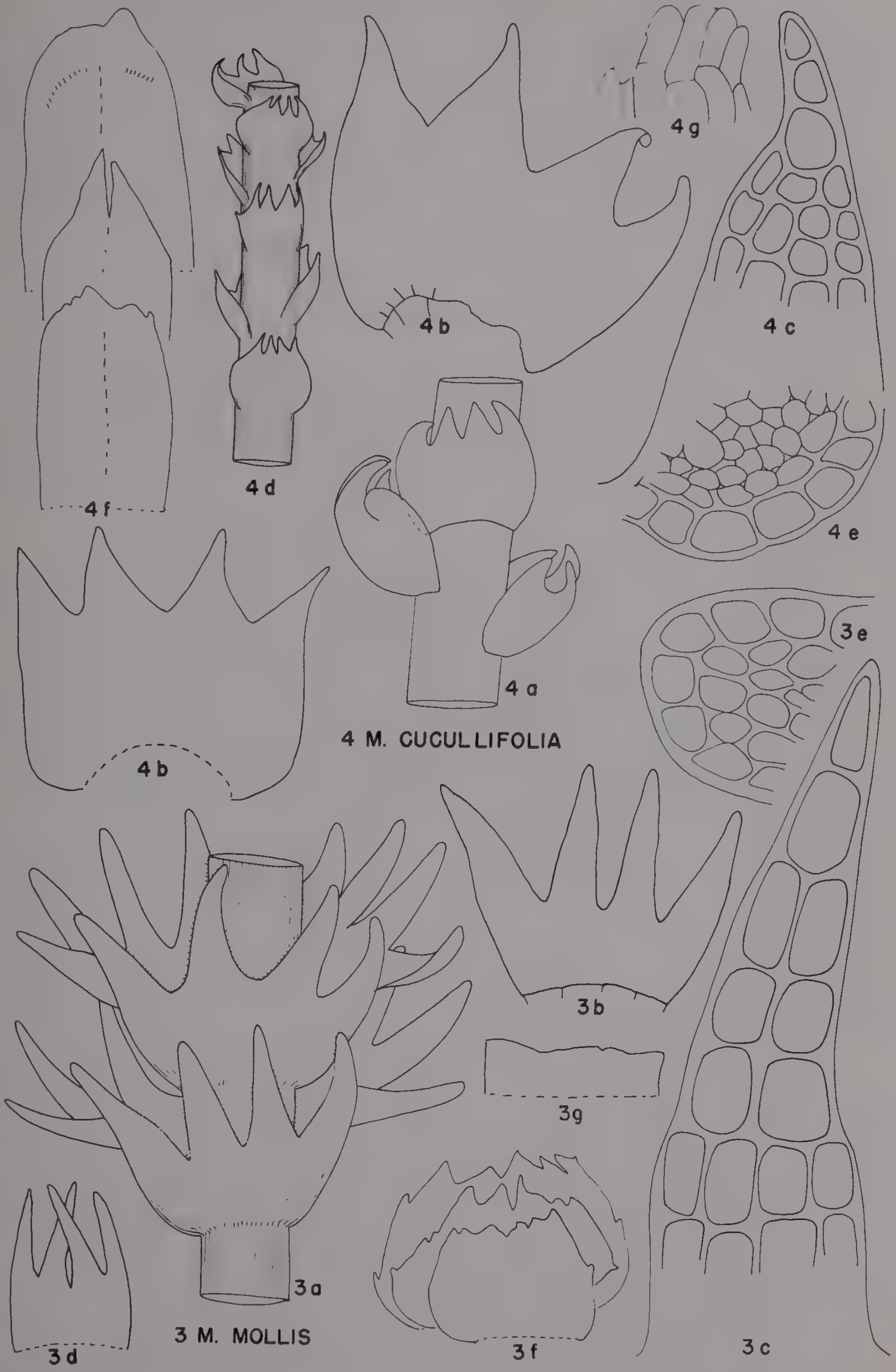
4 g
4 d
4 f
4 b
4 c
4 e
4 a
4 M. CUCULLIFOLIA
4 b
3 e
3 b
3 g
3 a
3 d
3 M. MOLLIS
3 f
3 c

Plate 48

quadrifid to one-third their length; the segments broadly triangular from an 8- to 10-celled base, the apex ending in a row of two cells; leaf-cells at the base of the segments 18–25 × 18 μ, the walls uniformly thickened, the trigones inconspicuous, the cuticle faintly verruculose. Plants dioicous. Male inflorescence on a short ventral sexual branch or becoming intercalary on a longer ventral branch, the bracts and bracteoles in three to ten or more series, the bracts concave, bifid, the bracteoles plane. Female inflorescence (only one) on a short ventral branch, the bracts and bracteoles in 3 series, faintly keeled, long oval in outline, the apices of the bracts of the innermost series undivided or with a few blunt lobes and projecting cells. Perianth long cylindrical, contracted above, the mouth crenulate. Sporophyte not seen. Pl. 47. Fig. 4, a–g.

Habitat: On decaying logs, among *Sphagnum* and other bryophytes in wet woods.

PATAGONIA—TIERRA DEL FUEGO: Guaitecas I., *Dusén 387* (type G), *Dusén,* as *I. quadriloba* f. *etiolata* (G), *Dusén* (K); Magellan Straits, *Schubert,* ex Hb Moenkemeyer, *N12,* the type of *I. symmetrica* (G); Desolation I., Pto Angosta, *Dusén* (S-PA).

There are additional reports of the species from Argentina (Kühnemann, 1949) and Chile (Stephani, 1901a).

Microlepidozia (Spruce) Jörgensen, Berg. Mus. Schrifter **16:** 303. 1934.

Lepidozia subg. *Microlepidozia* Spruce, p.p., London Jour. Bot. **14:** 165. 1876.

Lepidozia subg. *II. Microlepidozia* Spruce, subdivision 1. Trans. Proc. Bot. Soc. Edinb. **15:** 359. 1885.

Telaranea K. Müller in Rabenhorst's Krypt.-Flora **8:** 1133. 1956. Non *Telaranea* Spruce.

Kurzia v. Marten, Flora **28:** 417. 1870; emend. Grolle, p.p., Revue Bryol. Lichénol. **32**(1–4): 166. 1963 (1964).

Plants of small to medium size, pale to dark green or brown; stems prostrate to ascending, irregularly or regularly pinnate or bipinnate; the lateral branches leafy, often becoming flagelliform in the outer part, those of one side of the stem of the *Frullania* type with the bifid or subulate half-leaf dorsal, those on the opposite side of the *Microlepidozia* type, with the bifid or subulate half-leaf ventral; ventral branches intercalary in the axils of the underleaves, long-flagelliform or short, sexual; stems in transverse section with a unistratose layer of 12-(16) cortical cells surrounding the often smaller cells of the medulla. Rhizoids on the scale-leaves of the flagelliform branches. Line of leaf insertion transverse with the leaves erect-spreading or incurved, or oblique with the leaves succubous. Leaves subquadrate to cuneate in outline, quadrifid (or trifid) to one-half or three-fourths, the segments equal or unequal, the base of the lamina eight to twelve rows of cells wide. Underleaves smaller or nearly equal to the leaves, deeply bifid, trifid or quadrifid, the segments unequal (rarely equal). Plants dioicous; male inflorescence on a short ventral sexual branch, catkin-like, rarely intercalary on a long lateral branch or on the stem, the bracts and bracteoles in two to six or more series; antheridia in the axils of the bracts; female inflorescence on a short ventral sexual branch, the bracts and bracteoles similar, different from the leaves, more or less ovate. Perianth long, of one layer of cells, cylindrical below, with three broad keels above, the mouth contracted, crenulate to laciniate-ciliate; capsule reddish-brown, the wall of two or three layers of cells, with brown knot-like thickenings along the radial walls of the outer surface, and bands of half-rings across the inner tangential walls of the innermost layer. Seta in transverse section with eight very large cells surrounding 12–16 smaller cells.

Type species: *Jungermannia capillaris* Swartz.

The genus in addition to being well represented in the tropical-subtropical areas of Latin America has several species in North America, Europe, Asia, and in New Zealand.

It may be distinguished from the other genera of the Lepidoziaceae by the presence of two types of lateral branching, the *Frullania* and *Microlepidozia* types, the absence of ventral stolons, and underleaves with some shorter, usually subulate segments.

Key to the Species

1. Leaf segments subulate, mostly two, rarely three cells wide at the base; leaves divided to three-fourths of their length, the lamina one or two rows of cells high; underleaves smaller than the leaves, the segments unequal. (subg. *Microlepidozia*).
  2. Plants yellowish-, reddish-, or blackish-brown; leaves spreading or erect in the outer part; leaf-cells longer than broad.
    3. Plants minute; leaves fragile and readily broken. 5. *M. fragillima.*
    3. Plants filiform to larger; leaves not brittle or breaking up.
      4. Cuticle conspicuously papillose; (leaf-cells quadrate, 12–16 μ). 2. *M. verrucosa.*
      4. Cuticle verruculose to striolate, never conspicuously papillose.
        5. Cells of the leaf segments twice as long as broad, to 36 μ or more long. 4. *M. flagellifera.*
        5. Cells of the leaf segments shorter, 24–27 μ long. 3. *M. herzogiana.*
  2. Plants pale green to yellowish-green or brownish-green, regularly pinnate or bipinnate; leaves spreading, concave with the segments curved upward; leaf-cells quadrate or nearly so.
    3. Cuticle of the leaf-cells conspicuously papillose. 2. *M. verrucosa.*
    3. Cuticle of the leaf-cells faintly to conspicuously verruculose. 1. *M. capillaris.*
1. Leaf segments triangular, mostly four (two to five) cells wide at the base, leaves quadrifid to one-half of their length, the lamina three rows of cells high; underleaves nearly as large as the leaves or smaller. (subg. *Macrophylla*).
  2. Leaf-cells of the base of the segments 30–36 × 18 μ, the tip usually of one cell, the cuticle striolate. 6. *M. uleana.*
  2. Leaf cells of the base of the segments 20–25 × 18 μ, the tip usually of a row of two cells, each 20–30 μ long, the cuticle smooth to faintly verruculose. 7. *M. brasiliensis.*

SUBGENUS MICROLEPIDOZIA

The leaves are transversely inserted, small, deeply quadrifid (trifid on some of the branches), to within one or two cells of the base. The underleaves are very small with one or more of the four or three segments (rarely only two on some of the branches) shorter than the rest.

1. Microlepidozia capillaris (Swartz) Fulford, Brittonia **14:** 122. *f. 59–61.* 1962.

Jungermannia capillaris Swartz, Prodromus 144. 1788.
Lepidozia capillaris Lindenberg in G. L. & N. Syn. Hep. 212. 1845.
Mastigophora capillaris (Swartz) Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Lepidozia (subg. *Microlepidozia*) *amazonica* Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 359. 1885.
Lepidozia (subg. *Microlepidozia*) *fusifera* Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 359. 1885.
Lepidozia (subg. *Microlepidozia*) *capillaris* K. Müller in Rabenhorst's Krypt.-Flora **6**^{2}: 275. 1914.
Kurzia capillaris (Swartz) Grolle, Revue Bryol. Lichénol. **32:** 173. 1963 (1964).
Kurzia amazonica (Spruce) Grolle, Revue Bryol. Lichénol. **32:** 173. 1963 (1964).

Plants small, light yellow-green to olive-green becoming pigmented with brown, forming depressed mats or scattered among other bryophytes; stems slender, prostrate, to 2 cm or more long, with leaves 0.25–0.35 mm broad, regularly pinnate to bipinnate; lateral branches numerous, diverging at a wide angle, 0.8–1.3 mm apart, mostly 1.2 cm long, leafy, occasionally becoming flagelliform in the outer part, the ventral intercalary branches frequent, long, flagelliform, the scale-like leaves with rhizoids at the bases; stem cells in longitudinal section elongate, uniformly thin-walled, averaging 96 × 18 μ, the cortical cells shorter, to 60 μ long, stem in transverse section of a unistratose layer of about 12 thin-walled cortical cells somewhat larger than the cells of the medulla. Line of leaf insertion transverse. Stem leaves distant to subimbricate, erect to squarrose-incurved in the outer half, quadrifid to within one or two cells of the base; segments subulate, two or three cells broad below and ending in a row of two to four cells, the dorsal segment more or less parallel to the stem, the cells 16–18 × 16 μ, the walls scarcely thickened, the cuticle verruculose. Stem underleaves distant, divided to near the base into three or four subulate segments, with usually two of the segments shorter than the others, the cells as in the leaf. Branch leaves and underleaves with one segment less. Plants dioicous. Male inflorescence on a short ventral sexual branch, the bracts and bracteoles in six or more series, the bracts larger than the leaves, concave, divided to above the middle into two or three long-pointed segments, the bracteoles plane, bifid. Female inflorescence on a short ventral sexual branch, solitary, one to several on a stem, the bracts and bracteoles ovate, those of the inner series to one-sixth divided into two or three ciliate laciniae, the lateral margins obscurely ciliate, the cells averaging 64 × 24 μ, thin-walled, the cuticle verruculose. Perianth to 5 mm long, three-keeled and contracted above, the mouth ciliate with the cilia to six cells long. Sporophytes not seen. Pl. 49. Fig. 1, a–m.

Habitat: Over soil, rocks and tree bases in woods.

CUBA: Sierra Maestra 450 m, *Ekman 5974* (S-PA), 1000–1200 m, *Ekman 8095, 8884* (S-PA).

JAMAICA: s.l., *Swartz* (type NY), s.l., ex Hb Lehmann (C); Blue Mountain Peak, 2472 m, *Hansen* (C); Newhaven Gap, *Evans 528* (NY); trail from waterfall to Caledonia Peak, 4000–4500 ft, *M. Farr 505* (IJ), *Wilds* (NY); s.l., *Börgensen* (G); s.l., *Husnot, Pl. Antill.* (as *J. setacea*) (G).

PUERTO RICO: El Yunque, *Evans 112, Pagán 478, 565* (NY); Río Blanco, *Steere 6927* (Hb Fulford); El Toro Trail, *Steere 7104, 7254* (Hb Fulford); s.l., ex Hb Hampe (NY).

GUADELOUPE: Soufrière, *Le Gallo 242* (Hb Le Gallo); s.l., *Husnot, Pl. Antill. no. 355* (as *J. setacea*) (G).

DOMINICA: Laudat, *Lloyd 374* (NY).

TRINIDAD: Morne Bleu, *E. G. Britton 2308* (NY); El Tucuche, *E. G. Britton, Coker & Roland 1455* (NY); *Broadway 7099* (BM); Las Lapas Road, 1800 ft, *Alston 8950* (BM).

GUATEMALA: Sierra de Las Minas, *Steyermark 29965* (F).

Plate 49

FIG. 1. *Microlepidozia capillaris.* 1 a. Stem, dorsal view, × 80. 1 b. Stem, dorsal view (*L. fusifera*), × 80. 1 c. Stem, ventral view (*L. amazonica*), × 80. 1 d. A segment of a stem leaf, × 400. 1 e. Underleaf of a stem, × 180. 1 f. Underleaf of a branch, × 400. 1 g. Portion of a transverse section of a stem, × 350. 1 h. Upper portion of a female bract of the inner series, × 60. 1 j. Outline of a portion of the mouth of the perianth, × 90. 1 k. Cells of two segments of the perianth mouth, × 180. 1 m. Stem, ventral view, × 40; M, branch of the *Microlepidozia* type.

FIG. 2. *M. verrucosa.* 2 a. Stem, dorsal view, × 90. 2 b. Segment of a leaf, × 400. 2 c. Cell at the tip of a segment, × 275. 2 d. Underleaf of a stem, × 275. 2 e. Underleaf of a primary branch, × 275. 2 f. Underleaf of a secondary branch, × 275. 2 g. Transverse section of a stem, × 150. 2 h. Outline of the perianth mouth, × 180. 2 j. One lobe of the mouth of another

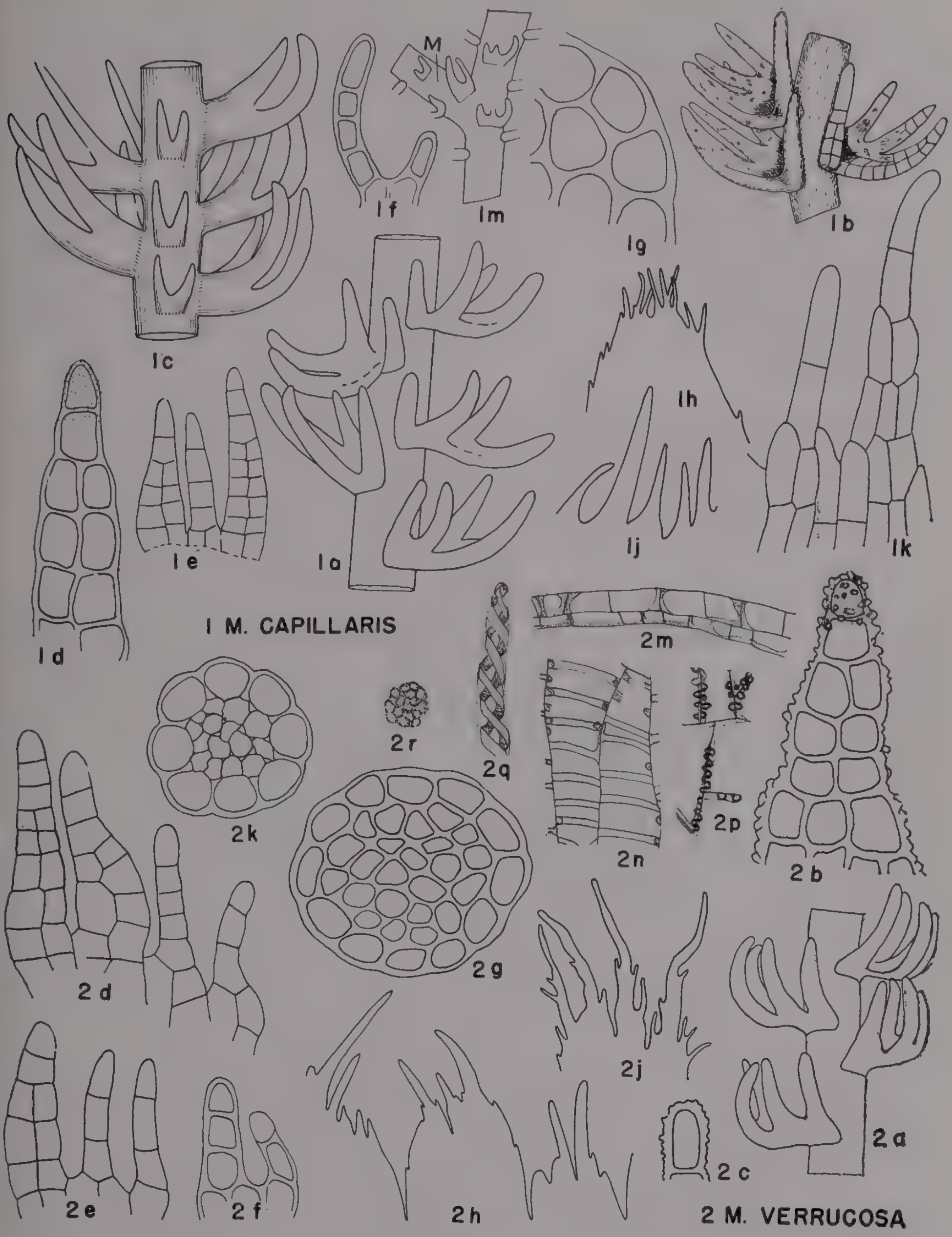
M
1 f
1 m
1 g
1 b
1 c
1 h
1 e
1 a
1 j
1 k
1 d
1 M. CAPILLARIS
2 m
2 r
2 q
2 k
2 n
2 p
2 b
2 g
2 d
2 j
2 a
2 c
2 e
2 f
2 h
2 M. VERRUCOSA

Plate 49

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perianth, × 180. 2 k. Transverse section of the seta, × 150. 2 m. Transverse section of a portion of the capsule wall, × 400; the thickenings stippled. 2 n. Cells of the inner surface of the capsule with thickening bands, × 400. 2 p. Cells of the outer wall of the capsule with knot-like thickenings along the radial walls, × 400. 2 q. Portion of an elater, × 400. 2 r. Spore, × 400.

Drawings, except 1 h–k and 2 b, j, from the types.

COLOMBIA: Cauca: Páramo de Las Papas, *H. Bischler 894, 1042 p.p.* (COL).

VENEZUELA: Cumbre de San Hilaris, *Goebel* (as *L. rufescens*) (G); Bolívar: Chimantá Massif, Río Tirica above upper Falls, 2090 m, *Steyermark & Wurdack 891* (NY); Río Tirica above Middle Falls, 1925 m, *Steyermark & Wurdack 466* (NY); s.l., Cerro Venamo, 1400–1450 m, *Steyermark & G. C. K. & E. Dunsterville 92630 p.p.* (VEN).

BRAZIL: s.l., *Burchell* (NY); near Rio de Janeiro, *Glaziou 7468* (BR, G, NY); Rio Negro, Manáos, *Spruce*, type of *L. amazonica* (MANCH-Kk960); S. Paulo: Jardim Botanico, *Fulford, Hatcher, Hell & Vital, 672 p.p., 698 p.p.* (Hb Fulford).

PERU: Andes, Mt. Campana, *Spruce, Hep. Spruc.*, type of *L. fusifera* (isotype S, BR, G, NY, FH); Guayrapurina, *Spruce, Hep. Spruc.* (G).

Other reports include Jamaica (Boswell, 1887), Puerto Rico (Hampe & Gottsche, 1852, Pagán, 1939), Brazil (Ångström, including *β minor*, 1876), Bolivia (Spruce, 1890), Chile—Patagonia (Bescherelle & Massalongo, 1889, Massalongo, 1927, Montagne, 1850), and Tierra del Fuego (Massalongo, 1885). These southern reports no doubt have reference to another species since *M. capillaris* appears to be tropical and subtropical in its distribution. *M. capillaris* is the most widespread of the species of *Microlepidozia* in Latin America.

2. **Microlepidozia verrucosa** (Stephani) Fulford, Contr. Sci. Los Angeles Co. Mus. **26:** 2. 1958.

Lepidozia verrucosa Stephani, Hedwigia **24:** 167–168. Tab. 3, *f. 1–11.* 1885.

Lepidozia (subg. *Microlepidozia*) *verrucosa* Müller in Raberhorst's Krypt.-Flora **6**^{2}: 275. 1914.

Kurzia verrucosa (Steph.) Grolle, Revue Bryol. Lichénol. **32:** 173. 1963 (1964).

Plants small, greenish-yellow becoming olive-brown, in depressed mats or among other bryophytes; stems slender, prostrate, to 2 cm long, with leaves to 0.35 mm broad, more or less regularly bipinnate; lateral branches numerous, diverging at a wide angle, with many branches, leafy, often becoming flagelliform in the outer part; ventral branches intercalary axillary, infrequent, with few-celled scale leaves with rhizoids; stem in transverse section of a unistratose cortical layer of 12 cells somewhat larger than those of the medulla. Line of leaf insertion transverse. Stem leaves distant to subimbricate, deeply quadrifid to within a cell of the base, the segments subulate, more or less curved, one, or rarely two or three cells broad at the base, tipped with a row of two to four cells; cells 12–16 μ in diameter, the walls scarcely thickened, the cuticle coarsely papillose. Stem underleaves distant, quadrifid to within a cell or two of the base, with one or two of the segments shorter and less well developed, the cells as in the leaf. Branch leaves and underleaves, smaller, with one less segment. Plants dioicous. Female branches solitary, one to several on a stem, the bracts and bracteoles similar, ovate the innermost series long ovate, bifid to one-fifth their length, the margins short-dentate, -ciliate or -laciniate, the cells averaging 64 × 16 μ, thin-walled, the cuticle striolate. Perianth long, contracted above, the mouth ciliate-laciniate. Capsule stalk (seta) in transverse section with an outer layer of eight large cells surrounding a medulla of many smaller cells. Capsule long-ovoid, light brown, the wall of two layers of cells with characteristic thickenings; spores brown, 12 μ in diameter, with coarse warts; elaters to 300 × 10 μ, bispial, the ends tapering, blunt. Male inflorescence not seen. Pl. 49. Fig. 2, a–r.

Habitat: On soil, logs and tree bases in humid woods.

JAMAICA: s.l., *Swartz*, ex Hb Jack (scraps) (G-215); gap to Caledonia Peak, *M. Farr 685* (IJ).

PUERTO RICO: e slope, Luquillo Mountains, *Heller 4638* (ABSH, G-469).

GUADELOUPE: s.l., *Marie 59*, ex Hb Bescherelle (G-472).

DOMINICA: s.l., *Elliott, Hep. Dom. Elliott. no. 144 p.p.* (G-471).

GUATEMALA: Zacapa, *Steyermark 43304* (F); above Volcán Santa Luisa, *Steyermark 43527 p.p.* (F).
COLOMBIA: Las Gagues, *Alston 7494A* (BM).
VENEZUELA: Mérida: La Aguada, *Magdefrau 654 p.p.* (Hb Fulford); Táchira, *Steyermark 5739 p.p.* (F); Lara, *Steyermark 53391; 55396* (F).
BRAZIL: near Rio de Janeiro, *Glaziou,* 1889 (G-475), *Glaziou 17, 978, 7476,* ex Hb Bescherelle (FH, NY); n of Annapolis, *Dawson 1131* (LAM); Itatiaia, *Ule 113* (G-474), *Fulford 770, 771 p.p.* (Hb Fulford); S. Paulo: s.l., *Ule,* ex Hb Jack (G-468), *Ule 299 p.p.* (G-651); s.l., *Ule 418* (G); S. Francisco, *Ule* (type G, isotypes FH, NY); St. Vincent near Santos, *Horian* (G-470); Mt. Jaraguá in Taipas, 800–1050 m, *Schiffner, Crypt. exsic. Mus. Hist. Nat. Vindobonense no. 4383* (C). Paraná: Mt. Agaloa, *Dusén,* 1904 (G-437); s.l., *Dusén* (FH, NY).

In size and general aspect *M. verrucosa* is similar to *M. capillaris* and the distribution patterns of the two overlap, but in *M. capillaris* the cuticle of the leaves and underleaves is faintly to conspicuously verruculose rather than plainly papillose. The coarsely papillose cuticle of the cells immediately distinguishes *M. verrucosa* from the other species of *Microlepidozia.*

3. **Microlepidozia herzogiana** (Stephani) Fulford, Brittonia **14:** 122. 1962.

Lepidozia herzogiana Stephani, Bibliot. Bot. **21**(87): 226. *f. 168, c.* 1916.

Plants filiform, deeply pigmented with yellow-brown, in mats or among other bryophytes; stems slender, prostrate, to 5 mm long, with leaves to 0.35 mm broad, regularly pinnate to bipinnate; lateral branches 1–2 mm apart, 2 mm long, diverging at a wide angle, ventral branches occasional, flagelliform, with scale-like leaves. Line of leaf insertion transverse. Stem leaves distant to subimbricate, spreading but curved upward in the outer part, subquadrate, to 0.2 mm long and broad, quadrifid to three-fourths their length, with a lamina one or two rows of cells high and eight cells wide, the segments subulate, four to seven cells long, two (three) cells wide below, ending in a uniseriate tip of two or three cells, the cells 24–27 × 18 μ, the tip cell 30–34 × 16 μ, the walls slightly thickened, the cuticle striolate-verruculose. Underleaves trifid or bifid, the segments of unequal length, the cells as in the leaf. Plant dioicous, monoicous (?). Female inflorescence on a short ventral sexual branch, the bracts and bracteoles in three or four series, the inner series laciniate-ciliate above. Perianth long (old), the mouth short-ciliate. Male inflorescence and sporophyte not seen. Pl. 50. Fig. 3, a–d.
Habitat: On bark of trees.

PERU: s.l., *d'Orbigny,* ex Hb Montagne (G, two packets, one as *L. capillaris,* the other *L. fusifera*), the same, Hb Montagne (PC).
BOLIVIA: Corani, 1900 m, *Herzog 4669,* (as *L. amazonica*) (G); Paracti, 2000 m, *Herzog 5032,* (type G).

4. **Microlepidozia flagellifera** (Stephani) Fulford, Brittonia **14:** 122. 1962.

Lepidozia flagellifera Stephani, Spec. Hep. **3:** 571. 1909; Icon. Hep., *Lepidozia No. 56.*
Kurzia flagellifera (Steph.) Grolle, Jour. Jap. Bot. **39:** 80. 1964.

Plants filiform, light yellow-brown; stems very slender, 3–4 cm long, with leaves to 0.3–0.4 mm broad, regularly bipinnately branched, the lateral branches 3 mm apart, to 4 mm long, diverging at a wide angle, the ventral branches flagelliform; stem in transverse section six to eight cells across, the cortical layer of about 12 cells slightly larger than the cells of the medulla. Line of leaf insertion transverse. Stem leaves distant to approximate, spreading or

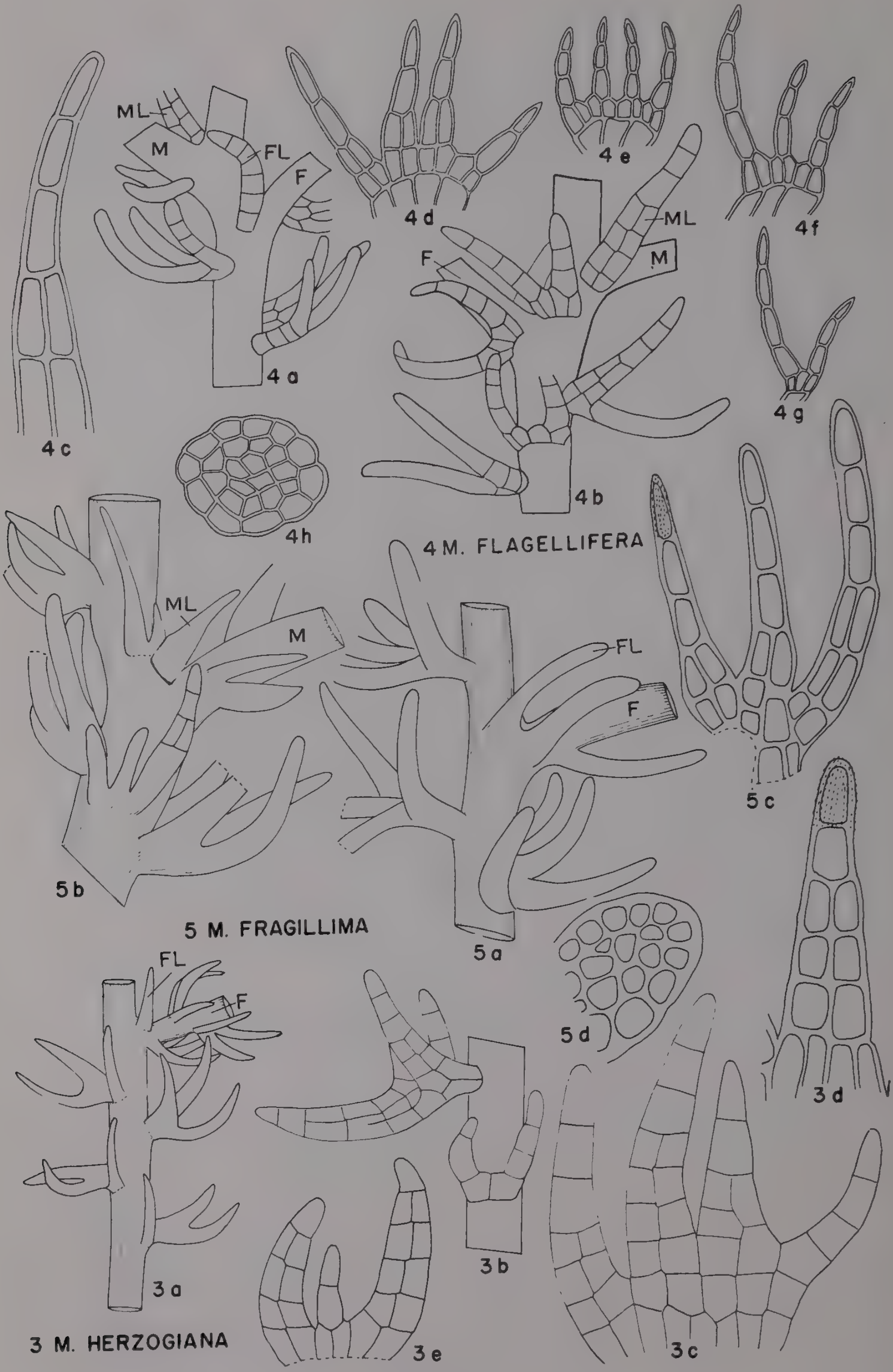
ML
M
FL
F
4 a
4 c
4 d
4 e
4 f
ML
M
F
4 g
4 b
4 h
4 M. FLAGELLIFERA
ML
M
FL
F
5 c
5 b
5 M. FRAGILLIMA
5 a
FL
F
5 d
3 d
3 a
3 b
3 M. HERZOGIANA
3 e
3 c

Plate 50

incurved in the outer part, quadrifid to within one cell of the base, the segments subulate, two cells wide at the base, four to six cells long, the cells 36–42 × 16–18 μ, the walls scarcely thickened, the cuticle faintly striolate or verruculose. Underleaves smaller, quadrifid or trifid to within one row of the base, one or two segments uniseriate and of three or four cells, the other often long-triangular from a 2-celled base, the cells as in the leaf. Leaves and underleaves of the secondary branches smaller and with fewer segments. Sexual branches and sporophyte not seen. Pl. 50. Fig. 4, a–h.

Habitat: On trees or rocks along streams.

GUATEMALA: El Progreso, above Volcán Santa Louisa, *Steyermark 43531* (F).
VENEZUELA: s.l., ex Hb Sande LaCoste (type G).
BRAZIL: Itatiaia, at ravine along river, *Fulford, Hatcher, Hell & Vital 775* (Hb Fulford).

The species has been reported from Brazil by Herzog (1925a).

5. Microlepidozia fragillima (Herzog) Fulford, Brittonia **14:** 122. 1962.

Lepidozia fragillima Herzog in Skottsberg, Nat. Hist. Juan Fernandez Easter Is. **2**^{5}: 726. *f. 6.* 1942.
Kurzia fragillima (Herzog) Grolle, Revue Bryol. Lichénol. **32:** 174. 1963. (1964).

Plants filiform, in depressed, tangled, yellow-brown mats; stems very slender, fragile, brittle, 2–4 cm or more long, with leaves 0.16 mm wide, pinnate or bipinnate, the lateral branches long often becoming long flagelliform at the tip, the ventral branches occasional, leafy or flagelliform; stems in transverse section with a cortical row of about 12 cells somewhat larger than the cells of the medulla. Line of leaf insertion transverse. Leaves distant to subimbricate, spreading but curved upward in the outer part, stem leaves quadrifid, branch leaves trifid or bifid to within one cell of the base, brittle and broken, the lamina six to eight-cells wide; segments subulate, four to six cells long, mostly two cells wide at the base ending in a uniseriate tip of three or four cells, the cells 18–27 × 10–12 μ, the walls slightly thickened, the cuticle conspicuously striolate. Underleaves smaller, bifid or trifid, the segments unequal with one longer, the cells as in the leaf. Plants dioicous. Female inflorescence on a short ventral sexual branch, the bracts and bracteoles in three or four series, the inner series long-ovate, bifid to one-half, with two ciliate laciniae. Male inflorescence, perianth, and sporophyte not seen. Pl. 50. Fig. 5, a–d.

Habitat: On soil in shaded woods.

Plate 50

Fig. 3. *Microlepidozia herzogiana.* 3 a. Stem, dorsal view, × 50; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch. 3 b. Stem, ventral view, × 275. 3 c. Leaf × 300. 3 d. Segment of a leaf, × 350. 3 e. Underleaf, × 300.

Fig. 4. *M. flagellifera.* 4 a. Primary branch, dorsal view, × 150; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 4 b. Secondary branch, ventral view, × 150; F, branch of the *Frullania* type; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 4 c. Leaf segment, × 350. 4 d. Leaf of a primary branch, × 180. 4 e. Leaf of a secondary branch, × 180. 4 f. Underleaf of a primary branch, × 180. 4 g. Underleaf of a secondary branch, × 180. 4 h. Transverse section of the stem, × 360.

Fig. 5. *M. fragillima.* 5 a. Stem, dorsal view, × 225; F, branch of the *Frullania* type; FL, half-leaf with this branch. 5 b. Stem, ventral view, × 225; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 5 c. Branch leaf, × 350. 5 d. Transverse section of a portion of a stem, × 350.

Drawing from the types.

JUAN FERNANDEZ: Masatierra, *Skottsberg* [1916–17] *232,* (type, Hb Herzog).

SUBGENUS MACROPHYLLA Fulford, Brittonia **14:** 122. 1962.

Kurzia subg. Macrophylla (Fulford) Grolle, Jour. Jap. Bot. **39:** 80. 1964.

The plants are somewhat larger than those of the subgenus *Microlepidozia* and the leaves are transverse, or obliquely inserted; the segments of the leaves and underleaves are triangular with a base of (two), three or four cells; and the segments of the underleaves are unequal.

6. Microlepidozia uleana (Stephani) Fulford & J. Taylor, Jour. Hattori Bot. Lab. **21:** 83. *f. 15–18.* 1959.

Lepidozia uleana Stephani, Spec. Hep. **3:** 566. 1909; Icon. Hep., *Lepidozia No. 35.*
Kurzia uleana (Steph.) Grolle, Revue Bryol. Lichénol. **32:** 174. 1963 (1964).

Plants small, fuscous brown, in mats or among other bryophytes; stems slender, to 2 cm long, with leaves to 3–4 mm broad, regularly pinnately branched, the lateral branches distant, widely divergent, leafy, often becoming flagelliform in the outer part, the ventral branches flagelliform, with scale-like leaves; stems in transverse section brown, with a cortical layer of about 12 cells slightly larger than the cells of the medulla. Line of leaf insertion on the stem transverse, on the branches becoming oblique with the leaves succubous. Stem leaves asymmetric, subquadrate to ovate-truncate in outline, quadrifid to the middle, the lamina three to five rows of cells high, to 12 rows of cells across at the base; segment spreading, triangular from a (2-), 3- or 4-celled base, four to six cells high, the apex usually of one cell; cells of the base of the segments mostly 30–36 × 16 μ, the tip cell 30–40 μ long, the walls slightly thickened, the cuticle striolate. Underleaves large, quadrifid to the middle or below, the segments triangular, one or two shorter than the others. Female inflorescence on a short ventral sexual branch, the bracts and bracteoles similar, the innermost series ovate, divided above into two or three laciniae, the margins of the lamina toothed. Perianth to 4 or 5 mm long, cylindrical below, contracted above, the mouth laciniate. Male inflorescence not seen. Pl. 51. Fig. 6, a–g.

Habitat: Not given.

BRAZIL: Tropical, without locality, *Ule 397* (type G).

7. Microlepidozia brasiliensis (Stephani) Fulford & J. Taylor, Jour. Hattori Bot. Lab. **21:** 83. *f. 19–22.* 1959.

Psiloclada brasiliensis Stephani, Spec. Hep. **3:** 550. 1909; Icon. Hep., *Psiloclada No. 1.*
Kurzia brasiliensis (Steph.) Grolle, Revue Bryol. Lichénol. **32:** 174. 1963 (1964).

Plants small, fuscous brown, in mats or among other bryophytes; stems slender, to 3 cm long, with leaves to 0.4 mm broad, regularly pinnately branched, the lateral branches 0.8–1 mm apart, 1.0 mm long, widely spreading, leafy, the ventral branches occasional, flagelliform with scale-leaves; stems in transverse section brown, with a cortical layer of 12 (–16) cells, scarcely larger than the cells of the medulla. Line of leaf insertion oblique, the leaves succubous. Leaves distant to subimbricate, obovate to cuneate in outline, the lamina three or four rows of cells high, quadrifid (trifid) to the middle or below; segments spreading, triangular, from a (2-), 3- or 4-celled base, four to seven cells long, the apex usually ending in a tip of two cells 20–30 × 17 μ; leafcells of the base of the segment 21–25 × 18 μ, the cuticle smooth to faintly verruculose. Underleaves large to small, cuneate to quadrate in outline, deeply quadrifid, trifid or bifid,

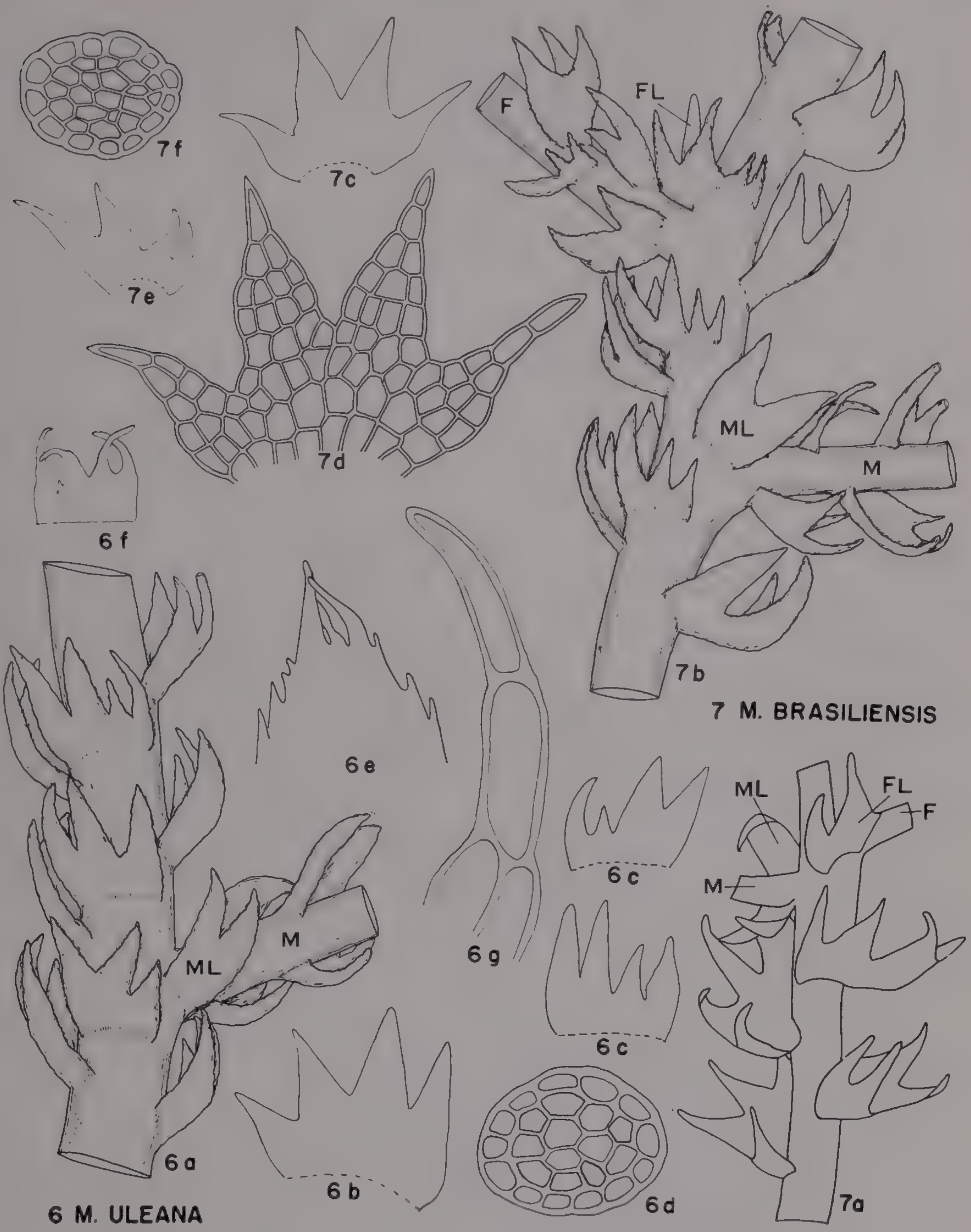

Plate 51

Fig. 6. *Microlepidozia uleana.* 6 a. Stem, ventral view, × 90; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 6 b. Stem leaf, × 90. 6 c. Stem underleaves, × 90. 6 d. Transverse section of a stem, × 180. 6 e. Upper portion of a female bract of the inner series, × 130. 6 f. Portion of the mouth of the perianth. 6 g. Tip of a segment of the perianth mouth, × 400.

Fig. 7. *M. brasiliensis.* 7 a. Stem, dorsal view, × 65; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch; M, branch of the *Microlepidozia* type; ML, ventral half-leaf with this branch. 7 b. Stem, ventral view, with these same types of branches, × 90. 7 c. Leaf, × 90. 7 d. Stem leaf, × 180. 7 e. Stem underleaf, × 90. 7 f. Transverse section of the stem, × 180.

Drawings, except 6 e, f, g, and 7 a, after Fulford and J. Taylor, 1959.

the segments triangular or subulate, one or two shorter than the rest, the cells as in the leaf. Plants dioicous. Male inflorescence intercalary on a branch, the bracts and bracteoles in several series, the bracts smaller than the leaves, concave, bifid, with a tooth on each side of the lamina, the bracteoles small, plane. Female in florescence and perianth not seen. Pl. 51. Fig. 7, a–f.

Habitat: On soil.

BRAZIL: s.l., *Ule 299,* (type G-659); Apiahy, *Puiggari* (G); Chapada dos Veadeiros region, *Dawson 14654* (LAM, Hb Fulford).

Telaranea Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 365, 1885; emend. Schiffner in Engler & Prantl, Nat. Pflanzenf. **1³:** 103. 1895; emend. Fulford, Brittonia **15:** 66. 1963.

Lepidozia (subg. *Telaranea*) K. Müller in Rabenhorst, Krypt.-Flora **6²:** 276. 1914.
Telaranea (subg. *Telaranea*) Schuster, Jour. Hattori Bot. Lab. **26:** 256. 1963.
Lepidozia auctt. p.p.
Blepharostoma auctt. p.p.

Plants small, pale green to yellowish-green, in mats; leafy stems radially symmetric to dorsiventral, erect or prostrate, regularly or irregularly pinnate to bi-tripinnate; lateral branches long, leafy, of the *Frullania* type with the quadrifid, bifid or subulate half-leaf dorsal, sometimes becoming attenuate-flagelliform in the outer part; ventral branches axillary, intercalary, leafy, or flagelliform with scale-like leaves, or short, sexual; stems in transverse section of a unistratose cortical layer of six, nine, twelve, fifteen or eighteen, large, thin-walled cells surrounding the medulla of smaller cells, the number of cortical cells equaling the number of segments of two leaves and an underleaves of one spiral on the stem. Rhizoids from small basal cells of the underleaves, the base of a ventral branch, or the scales of the flagelliform branches. Line of leaf insertion transverse, the basal cells "wedged in" between adjacent horizontal rows of cortical cells. Leaves divided to one-half or more into four, five or six segments; or to the base, or to within one-half cell of the base, into two, three (or four) segments; segments uniseriate throughout, four to six or eight cells long, the lamina one-half, one, two, three or four rows of cells high, or absent, the margins without teeth; cells thin-walled, longer than broad. Branch leaves and underleaves with one or two segments less. Underleaves as large as and similar to the leaves, or much reduced, bifid-trifid and two to four cells long. Plants dioicous or autoicous (K. Müller, 1956). Male inflorescence terminal on a leafy stem or long branch, becoming intercalary in position, the bracts and bracteoles in five or more series; antheridia in the axils of the bracts. Female inflorescence without innovations, terminal on the stem or long branch, or a short ventral axillary sexual branch, in one species the ventral sexual branch sometimes at the base of a lateral branch; bracts and bracteoles similar, in three to four series, different from the leaves. Perianth long, terete below, three-lobed above, of one layer of cells, the mouth contracted. Shoot/sporophyte relationship a shoot-calyptra. Capsule ovoid-cylindrical, reddish-brown, the wall of three layers of cells with characteristic markings; seta of eight or sixteen rows of large cells surrounding many smaller cells. Sporeling of the *Nardia* type, a small mass of cells developed outside the old exospore, from which the leafy plant develops.

Type species: *Blepharostoma sejuncta* Ångström (*Lepidozia chaetophylla* Spruce, as a synonym).

This genus is a remarkable example of a reduction series in the gametophyte, from more or less erect, radially symmetric, primitive types of leafy stem to the more simplified (reduced), mostly prostrate, dorsiventral type. The species *T. plumulosa* and *T. tetradactyla* have radial, erect, leafy stems. The leaves and underleaves of the stem have six (rarely five) segments, but on each successive branch there is a loss of one or two segments with a corresponding decrease in the number of cortical rows of cells in the axis. Both species also occur in the New Zealand area. The most reduced or simplified species is *T. sejuncta*. It is widespread throughout tropical and subtropical South America and extends up into the Northern Hemisphere as far as New York, Ireland and Germany. In the most simple condition the leaf consists of two segments five or more cells long and no lamina, while the underleaf has two segments only two cells long. The stem then consists of only six rows of large cortical cells surrounding the medulla. So far as is known, this is the only species which many be dioicous or autoicous.

Key to the Species

1. Stem leaves divided to the base into two, three, or rarely four uniseriate segments, or each segment from a base of two cells, these two, four, six, or eight cells joined for at least half their length to form a lamina one-half to one row of cells high.
  2. Underleaves conspicuously shorter than the leaves, bifid or rarely trifid.
    3. Stems 2–4 cm or more long, the lower cells of the leaf segment mostly 75–100 μ or more long, the tip cell shorter. 1. *T. sejuncta.*
    3. Stems at most 1 cm long, fragile.
      4. Largest cells of the leaf segment to about 70 μ long, the upper cells shorter. 2. *T. pseudozoopsis.*
      4. Largest cells of the leaf segment 50 μ long or less. 1a. *T. sejuncta* var. *breviseta.*
  2. Underleaves as long as the leaves and very similar.
    3. Leaves about 0.32 mm long, the segments often incurved, the cells averaging 54 μ long. 3. *T. apiahyna.*
    3. Leaves about 0.8 mm long, the segments spreading, bristle-like, the cells averaging 90–100 μ long. 4. *T. blepharostoma.*
1. Stem leaves with a lamina one to four rows of cells high and six, eight, ten or twelve cells wide; underleaves large, essentially like the leaves.
  2. Stem leaves and underleaves with a lamina four or three rows of cells high, and segments four to six cells long; perianth mouth crenulate. 6. *T. plumulosa.*
  2. Stem leaves and underleaves with a lamina one to three rows of cells high; mouth of the perianth long ciliate.
    3. Stem leaves with a lamina two cells high at the margin, three or four cells high between, lower cells of the segments about 70 × 20–25 μ. 5. *T. tetradactyla.*
    3. Stem leaves with a lamina two or even only one row of cells high.
      4. Stem leaves and underleaves stiff, erect-spreading, bristle-like, cells of the segment 90–100 μ long. 4. *T. blepharostoma.*
      4. Stem leaves and underleaves with the segments often incurved toward the stem, never bristle-like; cells of the segment under 60 μ long.
        5. Leaf lamina of two distinct rows of cells; cilia of the bracts and perianth mouth with distinct spines and branches (not known from South America). 7. *T. neesii.*
        5. Leaf lamina of only one row of cells; the cilia of the perianth without spines or branches. 3. *T. apiahyna.*

1. **Telaranea sejuncta** (Ångström) S. Arnell, Bot. Not. **110:** 17. *f. 132–147.* 1957.

Blepharostoma sejuncta Ångström, Öfvers. Vet.-akad. Forhandl. **33** (7): 78. 1876.
Jungermannia nematodes Gottsche, *Hep. Cub. Wright.* Nomen nudum.
Cephalozia nematodes Austin, Bull. Torrey Club **6:** 302. 1879.
Lepidozia bicruris Stephani, Hedwigia **24:** 166. t. 3. 1885.
Lepidozia chaetophylla Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 362, 365. 1885.

Telaranea chaetophylla (Spruce) Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 365. 1885.
Lepidozia nematodes (Austin) Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 366. 1885.
Lepidozia chaetophylla var. *tenuis* Pearson, Christiania Videnskaps.-Selskabs Forhandl. **1886**^{3}: 7. 1886.
Blepharostoma antillarum Bescherelle & Spruce, Bull. Soc. Bot. France **36**: 183. 1889.
Blepharostoma nematodes (Austin) Underwood, Bull. Torrey Club **23**: 383. 1896. [footnote]
Telaranea nematodes antillarum (Bescherelle & Spruce) Howe, Bull. Torrey Club **29**: 284. 1902.
Telaranea nematodes (Austin) Howe, Bull. Torrey Club **29**: 284. 1902.
Telaranea nematodes longifolia Howe, Bull. Torrey Club **29**: 286. 1902.
Telaranea bicruris (Stephani), Howe, Bull. Torrey Club **29**: 287. 1902.
Lepidozia sejuncta (Ångström) Stephani, Spec. Hep. **3**: 563. 1909.

Plants small, filamentous, in light green to whitish patches; leafy stems slender, filiform, ascending, 2–4 cm long, pinnate to bipinnate, the lateral branches short or long, very close to distant, rarely becoming flagelliform, the half-leaf subulate or bifid, the ventral branches long, leafy or flagelliform, or short, sexual; stem in transverse section with a unistratose cortex of six to twelve large cells surrounding the medulla of numerous smaller cells. Rhizoids short, from small cells at the base of the underleaf or from the base of a flagelliform branch. Line of leaf insertion transverse. Stem leaves delicate, spreading, of two, three or four approximately equal, long filamentous segments, four to six cells long, or each segment from a 2-celled base, the bases joined for about half their length and forming a lamina four, six, or eight cells across and half a cell high; cells of the segments just above the base 75–100 μ or more long, the cells of the upper part 60–80 μ long, the walls thin, the cuticle smooth. Stem underleaves variable, smaller than the leaves, bifid, trifid when the leaves are trifid, etc.), the segments of two to four, rarely more, elongate cells from a base of four or more small cells bearing rhizoids. Branch leaves with one less segment, branch underleaves often very small and only two cells broad at the base and two cells long. Plants dioicous and autoicous (Müller, 1956). Male inflorescence terminal on the stem or lateral branch, the bracteoles in five to many series, the monandrous bracts similar to the leaves, the bracteoles similar to the branch underleaves; antheridia large, spherical, the stalk of one row of cells. Female inflorescence on a very short ventral sexual branch, occasionally terminal on the stem or leafy branch, the bracts and bracteoles similar, in three or four series, large, quadrate to rectangular in outline, divided to one-half of their length or less, into usually four laciniate laciniae with occasional marginal spines, the cells 90–120 μ long, thin-walled. Perianth to 1.7 mm long, fusiform with three rounded keels above, contracted, the mouth of to 12 laciniae terminated by long, unbranched cilia, the cells long as in the bracts and bracteoles. Capsule dark brown, long ovoid, the wall of three layers of cells, the brown thickenings appearing as knots along the radial walls of the outer surface, and as bands or partial bands on the inner tangential wall; seta in transverse section of eight (to twelve) very large outer cells surrounding 16 to 24 smaller, thin-walled cells; foot inverted cone-shaped; elaters long, reddish brown, bispiral; spores brown, 14–16 μ, finely punctate. Pl. 52. Fig. 1, a–j.

Habitat: Decaying logs, humus, tree bases, and soil, or over other bryophytes, in swamps and moist forests.

PUERTO RICO: Sierra de Luquillo, *Steere 5169* (MICH).
GUADELOUPE: Le Gommier, *Ed. Marie 5125,* isotype of *B. antillarum* (G, NY).

DOMINICA: Morne Micotrin, *Elliott 1139d, 1140 p.p., 1143c p.p.* (BM): Hampstead Valley, *Elliott 1328a p.p.* (BM); Grand *Soufrière, Elliott 1843a p.p.* (BM); Morne Trois Pitons, *Elliott 2285 p.p.* (BM).

MEXICO: w of Huauchinango, *Sharp 883 p.p.* (TENN).

GUATEMALA: Chiquimula, *Steyermark, 31629* (F); Suchitepéques, s w slope of Volcán Zunil, *Steyermark 35289* (F).

HONDURAS: Morazán: region of Agua Amarilla, 900–1100 m, *Standley, Molina & Chacón P. 5108, 5115* (F).

COSTA RICA: s of San José, *E. Little 5511* (Hb Little); s of El Empalme, *E. Little 5643* (Hb Little).

COLOMBIA: Meta: Cordillera La Macarene, Caño Tiranasi 700 m, *Schultes 11233 p.p.* (FH); Amazonas: Río Miritiparaná, Caño Guacaya, *Schultes & Cabrera 15793* (FH). Amazonas-Vaupés: Río Apaporis, Soratania, 250 m, *Schultes & Cabrera 11954* (FH).

VENEZUELA: Candinamara, *Bischler 100* (COL); Caracas, Las Flores, *Fulford & Steyermark 1037 p.p.* (Hb Fulford); Estado Araqua: Choroní Pass, *Fulford & Steyermark 1145 p.p.;* Estado Bolívar: Sierra Ichún, 625–725 m, *Steyermark 90248 p.p.* (VEN).

BRAZIL: São Francisco, *Ule #2*, the type of *L. bicruris* (G, isotype NY) *Ule #5*; Rio de Janeiro, *Glaziou 8514* (NY); S. Paulo: near Santos, *Schiffner 105 p.p.* (W); Itapecirca, *Schiffner 1546 p.p.* (W); Rio Negro, Silva Amazon, *Spruce, Hep. Spruc.* as *T. chaetophylla*, (isotype S-PA, BR, G); S Paulo: Jardim Botanico, *Fulford, Hatcher, Hell & Vital 585 p.p., 596 p.p., 602, 605 p.p., 615, 619 p.p., 620 p.p., 623, 628, 631 p.p., 634 p.p., 635 p.p., 642 p.p., 644 p.p., 646, 647 p.p., 648 p.p., 655, 656, 658, 659, 661 p.p., 662 p.p., 663, 671 p.p., 672 p.p., 673 p.p., 684 p.p., 686, 687, 688 p.p., 691, 692 p.p., 693 p.p., 694 p.p., 696, 697 p.p., 698 p.p.* (Hb Fulford); Itatiaia Park: forest along river, *Fulford, Hatcher, Hell & Vital 715, 725, 744, 774 p.p., 777, 779 p.p.* (Hb Fulford); Aguas Negros, 2350 m, *Fulford, Hatcher, Hell & Vital 906, 928* (Hb Fulford).

ECUADOR: El Oro, quebrado de Mono, *Steyermark 54245* (F).

PERU: Mt. Campana, *Spruce, Hep. Spruc.* as *T. chaetophylla* (G).

BOLIVIA: Valle Torcorani, 300 m, *Herzog 3841 p.p.* (G).

The species has also been reported from Cuba (Pagán, 1939), Puerto Rico (Pagán, 1939), Guadeloupe (Pagán, 1942), Mexico (Jovet-Ast, 1960), Brazil (Herzog, 1927, 1952a), British Guiana (Richards, 1954), Bolivia (Spruce, 1890), Chile (Arnell, 1955) and Juan Fernandez (Arnell, 1957, Herzog, 1942a).

The species is widespread throughout tropical and warm temperate America, extending northward along the coast of the United States to Long Island, eastward to the west coast of Ireland, West Pyrenees, the Azores and into tropical and South Africa.

1a. **Telaranea sejuncta** var. **breviseta** (Herzog) Fulford, Brittonia **15:** 71. 1963.

Lepidozia sejuncta var. *breviseta* Herzog in Skottsberg, Nat. Hist. Juan Fernandez Easter Is. **2**^{5}: 729. 1942.

Lepidozia breviseta (Herzog) S. Arnell, Hepaticae. Results Norweg. Sci. Exp. Tristan da Cunha 1937–1938. **42:** 14. 1958.

Telaranea breviseta (Herzog) S. Arnell, Hepaticae. Results Norweg. Sci. Exp. Tristan da Cunha 1937–1938. 14. 1958.

These plants are much smaller than is usual for the species. The stems are delicate and the leaves and underleaves are bifid and very small, a condition which one might expect to find on branches of depauperate plants. However, these plants do not appear to be depauperate. The leaf segments are uniseriate from the base or from a "lamina" half a cell high and three or four cells wide (one or two cells under each segment) as in *T. sejuncta* but the cells are shorter, only to 49 μ, and only about half as long as is usual for the species, although there is considerable variation in the length between the cells of one segment or between leaves of different plants.

The variety has much in common with the next species *T. pseudozoopsis* and may be closely related, but in the latter the leaves are mostly 3-parted, of

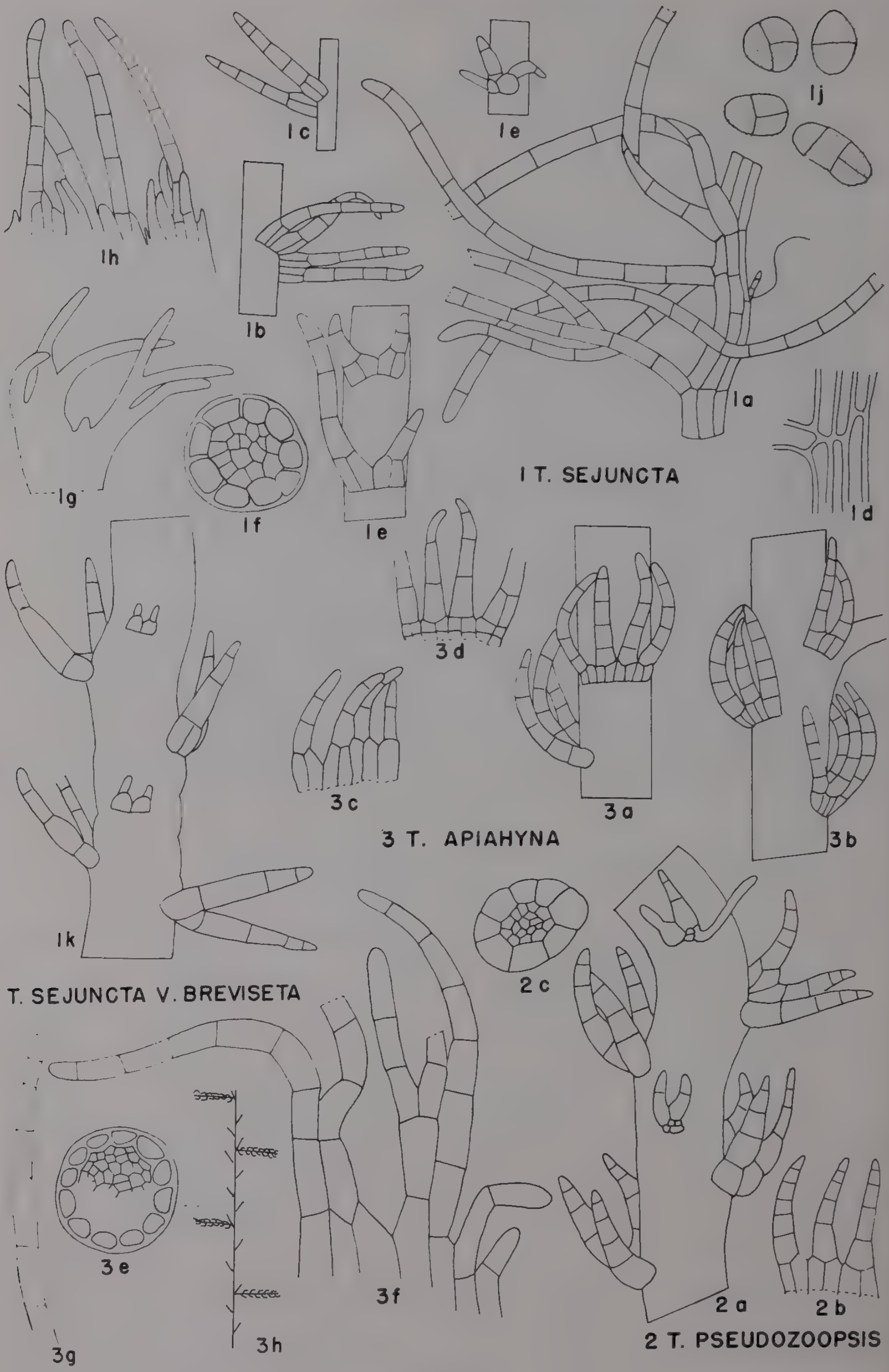
1h
1c
1e
1j
1b
1a
1g
1f
1e
1d
1 T. SEJUNCTA
3d
3a
3c
3b
3 T. APIAHYNA
1k
T. SEJUNCTA V. BREVISETA
2c
3e
3f
3g
3h
2a
2b
2 T. PSEUDOZOOPSIS

Plate 52

more cells, and the cells of the basal part are longer. Male and female inflorescences and sporophyte were not seen. Pl. 52. Fig. 1, k.

Habitat: On earth and tree roots.

JUAN FERNANDEZ ISLANDS: Masafuera, Quebrada del Mono, 370 m, *Skottsberg 142 p.p.* (type, Hb Herzog). It has also been reported from Tristan da Cunha by S. Arnell (1958).

2. Telaranea pseudozoopsis (Herzog) Fulford, Brittonia **15:** 71. *f. 148–150.* 1963.

Lepidozia pseudozoopsis Herzog in Skottsberg, Nat. Hist. Juan Fernandez Easter Is. **2**^{5}**:** 723. *f. 5.* 1942.

Plants very small, whitish green to yellowish, in small patches; stems very slender, to 1 cm long, with leaves to 0.15 mm broad, pinnate, the lateral branches distant, the half-leaf subulate, the ventral intercalary branches occasional; stem in transverse section of a cortical layer of six or eight large cells surrounding the numerous small cells of the medulla. Rhizoids from small cells of the bases of the underleaves. Line of leaf insertion transverse. Stem leaves distant, more or less ascending, incurved or spreading, quadrate in outline, mostly 0.35 mm long, trifid to within one cell of the base, the lamina one cell high, six cells across (two for each segment); segments to six cells long, cells near the base mostly 70 μ long, those near the tip shorter. Stem underleaves much smaller than the leaves, bifid or trifid, the segments one or two cells long. Branch leaves with one segment less. Male and female inflorescences similar to those of *T. sejuncta*. Pl. 52. Fig. 2, a–c.

Habitat: On wood, fern fronds, or over mosses.

JUAN FERNANDEZ: Centinella-Rücken, 530 m, *Skottsberg 227,* (type Hb Herzog). It has also been reported from Southern Patagonia (Herzog, 1954) and Juan Fernandez (Arnell, 1957).

This species appears to be closely related to *T. sejuncta* but it is of about one-third the size of that species and the cells are shorter.

3. Telaranea apiahyna (Stephani) Fulford, Brittonia **15:** 71. *f. 151–155.* 1963.

Lepidozia apiahyna Stephani, Spec. Hep. **3:** 572. 1909; Icon. Hep., *Lepidozia No. 39.*
Lepidozia digitisquama Herzog, Brotéria 6: 18. f. 1. 1937.

Plants very small, filamentous, whitish-green, in tufts or mats or among

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Plate 52

Fig. 1. *Telaranea sejuncta.* 1 a. Stem, dorsal view, × 150. 1 b. Quadrifid stem leaf, with a lamina eight cells broad and one-half high, × 75. 1 c. Bifid stem leaf, × 75. 1 d. Attachment of the leaf base to the stem, × 125. 1 e. Underleaves, × 150. 1 f. Transverse section of a stem, × 125. 1 g. Portion of a female bract of the inner series, × 90. 1 h. Portion of the perianth mouth, × 160. 1 j. Early stages in the germination of spores, × 350.

Fig. 1 k. *T. sejuncta* v. *breviseta.* Stem, ventral view, × 350.

Fig. 2. *T. pseudozoopsis.* 2 a. Stem, ventral view, × 150. 2 b. Leaf, × 90. 2 c. Transverse section of a stem, × 75.

Fig. 3. *T. apiahyna.* 3 a. Stem, ventral view, × 80. 3 b. Stem, dorsal view, × 80. 3 c–d. Underleaves, × 90. 3 e. Transverse section of the stem, × 90. 3 f. Portion of a female bract of the inner series, × 180. 3 g. One of the cilia of the perianth mouth, × 160. 3 h. Growth habit of the plant.

Drawings after Fulford, 1962, except 1 k, 3 f, 3 g from the types.

other bryophytes; leafy stems 1–2 cm long, more or less radially symmetric, regularly pinnately branched, the lateral branches usually short, densely leafy, the half-leaf from a two-celled base, usually bifid, the ventral branches mostly short and bearing a female inflorescence; stem in transverse section with a cortical layer of 12 large cells surrounding the smaller cells of the medulla. Rhizoids from small cells of the bases of the underleaves. Line of leaf insertion transverse. Stem leaves distant, ascendent incurved, quadrate in outline, averaging 0.35 mm long, quadrifid to within one cell of the base, the lamina one cell high, seven or eight cells across, two cells under each segment; segments uniseriate, of four to six cells, each 54–70 μ long. Stem underleaves similar, the lamina of a row of six or eight cells, or of several rows of smaller cells bearing rhizoids. Branches densely leafy, the leaves and underleaves often larger than those of the stem, with one or two segments less. Plants dioicous (?). Female inflorescence on a short or longer ventral branch or terminal on the stem or lateral branch; the female bracts and bracteoles similar, in three or four series, the innermost series deeply divided, laciniate with long cilia, the cells of the cilia 90–125 μ long, thin-walled. Perianth (immature), fusiform, with three rounded keels above, the mouth contracted, laciniate with the cilia very long, as in *T. sejuncta*. Male inflorescence and sporophyte not seen. Pl. 52. Fig. 3, a–g.

Habitat: On decaying logs and humus.

VENEZUELA: Estado Bolívar: Chimantá Massif, rocks, island in Río Tirica, 1925 m, *Steyermark & Wurdack 466 p.p.* (NY).

BRAZIL: Apiahy, *Puiggari 653,* (type G); Apiahy, *Puiggari, 692, 792* (G); "s Brasil," without collector, (NY); S. Paulo: Alto da Serra, Estacio Biologica, *Gehrt,* type of *L. digitisquama* (Hb Herzog); Itatiaia Park: Aguas Negros, 2350 m, *Fulford 906* (Hb Fulford); lower elevation, woods along river, *Fulford, Hatcher, Hell & Vital 715, 727, 762* (Hb Fulford); Taimbe, S. Francisco d. Paula, 900 m, *Sehnen 6803* (Hb Sehnen).

4. **Telaranea blepharostoma** (Stephani) Fulford, Brittonia **15:** 73. *f. 156–167.* 1963.

Lepidozia trichophylla Ångström ms.

Lepidozia blepharostoma Stephani, Bihang, Sv. Vet.-akad. Handl. III. **26⁶:** 23. 1900; [Icon. Hep., *Lepidozia No. 132,* is not of this species.]

Plants small, bristly capillaceous, yellowish to whitish green or dark green, in mats or tufts; leafy stems slender, radial, to 5–6 cm long, pinnate to bipinnate, the lateral branches frequent, long, with shorter secondary branches, the half-leaf subulate or bifid, the ventral branches frequent, becoming long flagelliform; stem in transverse section with a cortical row of nine or twelve large cells surrounding the many smaller cells of the medulla. Line of leaf insertion transverse. Stem leaves erect spreading, bristly, cuneate in outline, 0.65 mm long, 0.18 mm broad at the base, quadrifid (trifid on the branches) to within one and one-half cells of the base, the lamina one and one-half cells high, six or eight cells across (two for each segment), the cells mostly 36×22–27 μ; segments uniseriate, five or six cells long, straight and stiff, the lower cells 90–100×30–40 μ, the tip cell 65×12 μ. Stem underleaves similar, the lamina two rows of cells high and with usually six rows of cells and three segments. Plants dioicous. Female inflorescence on a short or somewhat longer ventral intercalary branch or occasionally terminal on a lateral branch, the bracts and bracteoles similar, in three or four series, ovate to rectangular in outline, divided to one-third of their length into two to four long-ciliate laciniae, the cells long, thin-walled. Perianth long, fusiform, contracted above, the mouth laciniate, the terminal cilia long, simple. Male inflorescence and sporophyte not seen. Pl. 53. Fig. 4, a–h.

Habitat: Over soil, logs or tree bases or among other bryophytes along banks and in forests.

PATAGONIA—TIERRA DEL FUEGO: Valparaiso, Hahn, ex Hb Jack (as *L. plumulosa* (G-259); Valdivia, *Krause* (G), as *L. trichophylla* Ångstr.; Desolation I., Pto Angosta, *Dusén 142*, ex Uppsala Bot. Mus., (type G); Pto Angosta, *Dusén 393* (G, NY); Magellan Straits, Smyth Channel, without collector, ex Hb Bescherelle (G); Halt Bay, *Cunningham 186*, ex Hb Kew (G).

Additional reports of the species include Patagonia (Herzog, 1954; Kühnemann, 1949, Stephani, 1911), Tierra del Fuego (Stephani, 1911), and Falkland Islands (Stephani, 1911; Skottsberg, 1913).

5. Telaranea tetradactyla (Hooker f. & T. Taylor) Hodgson, Records Dominion Mus. N. Z. **4**(11): 106. 1962.

Jungermannia tetradactyla Hooker, f. & T. Taylor, London Jour. Bot. **3**: 386, 475. 1845.
Lepidozia tetradactyla T. Taylor in G. L. & N. Syn. Hep. 213. 1845.
Lepidozia lindenbergii Gottsche in G. L. & N. Syn. Hep. 213. 1845.
Mastigophora tetradactyla Trevisan, Mem. Ist. Lomb. III. **4**: 416. 1877.
Lepidozia disticha Stephani, Sv. Vet.-akad. Handl. **46**(9): 62. *f. 24, a–b.* 1911 [in error—description and figure under *L. fernandeziensis*, p. 63, f. 24 e, belong to this species].
Lepidozia effusiseta Stephani, Spec. Hep. **6**: 305. 1922; Icon. Hep., *Lepidozia No. 134/135.*
Neolepidozia tetradactyla Fulford & J. Taylor, Brittonia **11**: 84. 1959. [in error].
Neolepidozia disticha Fulford & J. Taylor, Brittonia **11**: 84. 1959. [in error].

Plants small, filamentous, in light yellow-green tufts or mats; stems slender, 3–4 cm long, more or less radial, often erect, densely leafy above, regularly pinnate to bi- or tripinnate, the lateral branches long, the half-leaf bifid, ventral branches occasional, leafy throughout or with smaller leaves for some distance, then becoming densely leafy above; stems in transverse section with a cortical layer of 18 or 12 large cells surrounding a medulla of smaller cells. Rhizoids from small cells of the bases of the underleaves and the base of the female branch. Line of leaf insertion transverse. Stem leaves distant to approximate, rectangular to cuneate in outline, divided to two-thirds or four-fifths of their length into mostly four (sometimes five or six) segments, the lamina two cells high at the margins, two or three cells high between or one cell high at the margins and two or three cells high between, usually eight (ten or twelve) cells wide, the cells quadrate to rectangular, thin walled; segments uniseriate, four or five cells long, sometimes curved, the cells of the lower part averaging $73 \times 21\ \mu$. Underleaves similar, the segments four or five cells long, the lamina mostly two cells high throughout, eight (ten or twelve) cells wide. Branch leaves and underleaves with one or two segment less. Plants dioicous. Female inflorescence terminal on a leafy branch, more rarely on a short ventral branch, the bracts and bracteoles in four series, the outermost series quadrifid to one-half of their length, the intermediate series divided to one-third of their length into four segments with a few short cilia on the margins, the innermost series divided to one-half of their length, the segments undivided. Perianth 4–5 mm long, cylindrical to fusiform, with three rounded keels above, the mouth contracted, long ciliate with simple cilia. Capsule long ovoid, brown with the characteristic brown thickenings. Seta with an outer row of 16 large cells surrounding many smaller cells. Male inflorescence not seen. Pl. 53. Fig. 5, a–g.

Habitat: Over soil, banks, logs, tree bases, and other bryophytes, in shaded areas.

JUAN FERNANDEZ: Masatierra, *Skottsberg 194*, the type of *L. effusiseta* (G), *Skottsberg 117*, the type of *L. disticha* (G), *Skottsberg B14* (G); s.l., *Claude Gay*, ex Hb Jard. Bot. Bruxelles (G-256).

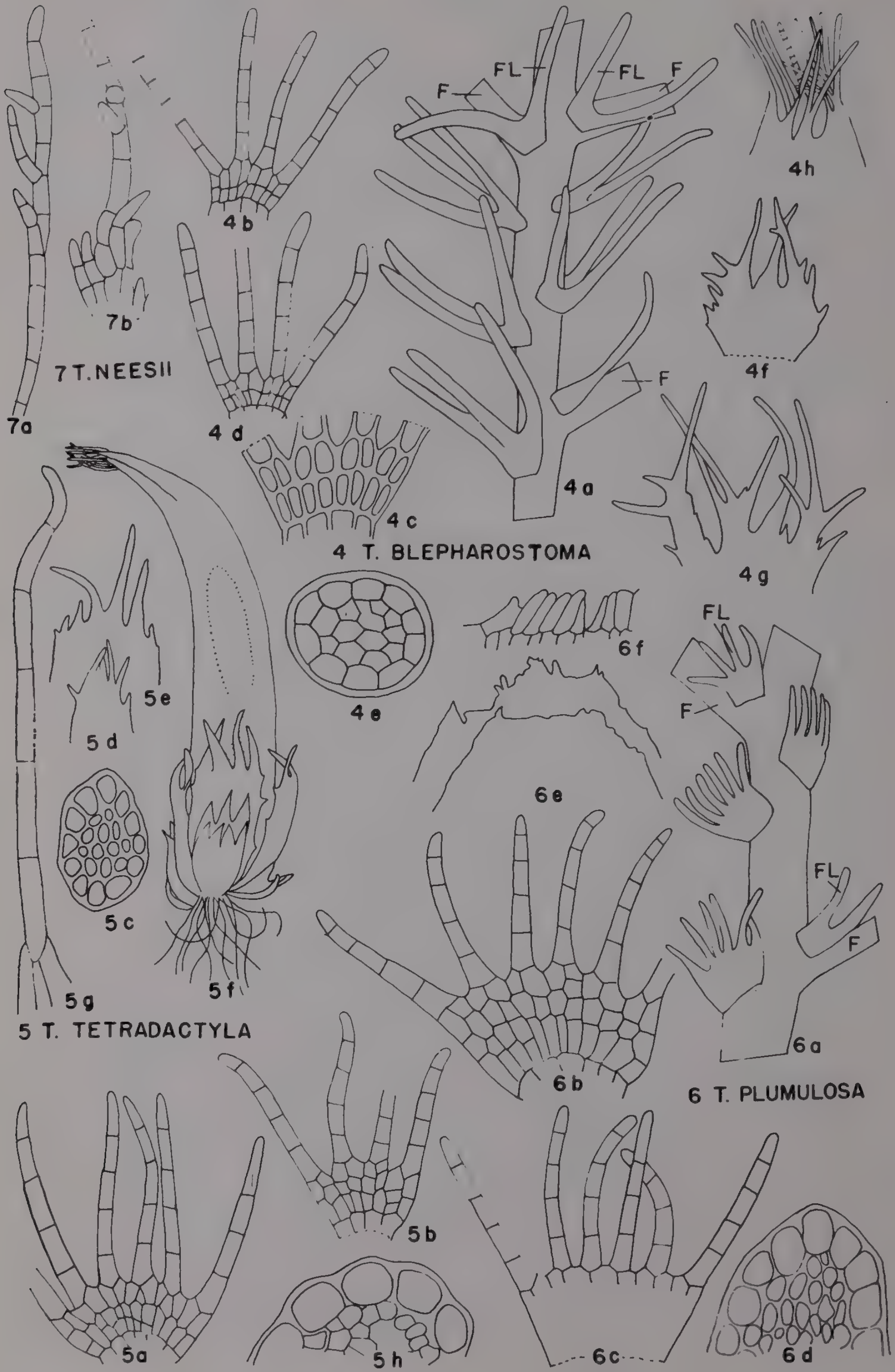
7a
7b
7 T. NEESII
4b
4d
FL
F
FL
F
F
4a
4c
4h
4f
4g
4 T. BLEPHAROSTOMA
4e
5e
5d
5c
5f
5g
5 T. TETRADACTYLA
6f
6e
FL
F
FL
F
6a
6b
6 T. PLUMULOSA
5a
5b
5h
6c
6d

Plate 53

PATAGONIA—TIERRA DEL FUEGO: Corral, *Thaxter 157 p.p.* (MICH); Puerto Varis, *Fulford 507 p.p., 540 p.p.* (Hb Fulford): Chiloe I., *Capt. King* (NY); Magellan Straits, *Nadaud F.803723 p.p.* (F); s.l., *Hahn* (G). Hermite I., without collector (NY); s.l., without collector (NY); Hoste I., Harding Peninsula, Orange Bay [Chilean ship "Yelcho"] *Chelminski 4 p.p., 11 p.p., 12 p.p.* (Hb Fulford).

FALKLAND ISLANDS: Pto Stanley, *Skottsberg 198* [1907] (G).

Additional collections have been reported from Patagonia—Tierra del Fuego (Arnell, 1957; Herzog, 1942a; Herzog & Schwabe, 1939; Massalongo, 1885).

The species was first collected on Auchland Islands by Hooker (NY) and appears to be fairly common in New Zealand and Austrialia as well as in the southern tip of South America. It is another of those species with an Antarctic distribution.

6. **Telaranea plumulosa** (Lehmann & Lindenberg) Fulford, Brittonia, **15:** 77. *f. 185–202.* 1963.

Jungermannia plumulosa Lehmann & Lindenberg in Lehmann, Pug. Pl. **6:** 30. 1834.
Lepidozia plumulosa (L. & L.) Lehmann & Lindenberg in G. L. & N. Syn. Hep. 211. 1845.
Lepidozia javanica Montagne, Voy. Pole Sud. Bot. **1:** 246. 1845. [American specimens]
Lepidozia neesii Montagne, Voy. Pole Sud. Bot. **1:** 246. 1845. [American specimens, as synonym] Non *L. neesii,* Lindenberg, 1845.
Jungermannia (*Lepidozia*) *javanica* (Montagne) Hooker, Flora Antarctica 1^2: 442. 1847.
Mastigophora javanica (Montagne) Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Mastigophora plumulosa (Lehmann & Lindenberg) Trevisan, Mem. Ist. Lomb. III. **4:** 416. 1877.
Lepidozia tetradactyla Stephani p.p., Spec. Hep. **3:** 603. 1909. Non *L. tetradactyla* T. Taylor.
Lepidozia magellanica Gottsche ms., nom. nud. Non *L. magellanica* Stephani, 1922.

Plants of small to medium size, whitish to greenish-yellow, filamentous, to compact and bristly, in mats or erect tufts; leafy stems 4–6 cm long, with leaves to 0.8 mm broad, fleshy, turgid, regularly bipinnate to sometimes tripinnate, often fan-shaped from an almost leafless base, the tips often recurved; lateral branches long with shorter secondary branches, a few becoming flagelliform, the dorsal half-leaf bifid or quadrifid, ventral branches occasional, long, leafy, rarely becoming flagelliform, or coarse with distant leaves below and becoming densely leafy above and readily detached from the stem, or short, female; stem in transverse section brownish-yellow, the unistratose cortex of 18 or 15 large cells surrounding the medulla of many smaller cells. Line of leaf insertion transverse. Rhizoids from cells of the bases of the underleaves. Stem leaves distant to subimbricate, subrectangular in outline, averaging 0.86–0.5 mm, erect spreading, 5- or 6-parted to near the middle, the lamina mostly four rows of cells high,

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Plate 53

FIG. 4. *Telaranea blepharostoma.* 4 a. Stem, dorsal view, × 40; F, branch of the *Frullania* type; FL, dorsal half-leaf with this branch. 4 b. Stem leaf, × 65. 4 c. Lamina of a leaf, × 150. 4 d. Underleaf, × 65. 4 e. Transverse section of a stem, × 125. 4 f. Female bract of the intermediate series, × 33. 4 g. Female bract of the inner series, × 33. 4 h. Upper portion of a perianth, × 33.

FIG. 5. *T. tetradactyla.* 5 a. Stem leaf, × 33. 5 b. Stem underleaf, × 33. 5 c. Transverse section of a stem, × 125. 5 d. Female bract of the intermediate series, × 33. 5 e. Female bract of the inner series, × 33. 5 f. Perianth, female bracts and sporophyte, × 30. 5 g. One of the cilia of the mouth of the perianth, × 90. 5 h. Transverse section of the seta, × 180.

FIG. 6. *T. plumulosa.* 6 a. Stem, dorsal view, × 25; F, branch of the *Frullania* type; FL, half-leaf with this branch. 6 b. Stem leaf, × 65. 6 c. Stem underleaf, × 65. 6 d. Transverse section of a stem, × 180. 6 e. Outlines of the upper portion of female bracts of the intermediate and inner series, × 33. 6 f. Cells of the mouth of the perianth, × 180.

FIG. 7. *T. neesii.* 7 a. One of the branched cilia of a female bract, × 75. 7 b. Portion of the mouth of a perianth, × 75.

Drawings after Fulford, 1962.

sometimes with only three rows in the dorsal part and four rows in the ventral, or with one cell less on the dorsal margin, 12 cells wide at the base (ten cells when there are five segments); segments uniseriate, four or five cells long, the lowest cell averaging 95 μ long, the tip cell 50 μ long, the walls uniformly thin. Stem underleaves similar, the lamina four (rarely three) rows of cells high, the cells of the six (or five) segments as in the leaf. Branch leaves and underleaves with four segments and a lamina eight cells wide. Plants dioicous. Male inflorescense terminal on a long lateral branch, the bracts and bracteoles in six to ten series, the bracts concave, bifid, the bracteoles smaller, bifid, plane. Female inflorescence at the tip of a lateral branch, a very short ventral branch, or a very short ventral branch from near the base of a leafy lateral branch, the bract and bracteoles similar, in three or four series, broadly ovate, with several short teeth and cilia at the apex, margins undulate, lobed and toothed. Perianth long, cylindrical to fusiform, contracted and with three broad keels above, the mouth crenulate. Sporophyte not seen. Pl. 53. Fig. 6, a–f.

Habitat: Over soil, wood, and other bryophytes in open woods and boggy meadows.

JUAN FERNANDEZ ISLANDS: Masatierra, Pangal, *I. & C. Skottsberg 2221* [1916–17] (NY).

PATAGONIA—TIERRA DEL FUEGO: Guaitecas I., *Dusén 356* (C, NY), s.n., *Dusén* (C); Desolation I.: Pto Angosta, *Dusén 260,* ex Hb Uppsala Bot. Mus. (G-252); s.l. *Dr. Lavatier,* ex Hb Bescherelle (G-260); Magellan Straits, *Dusén* (G-253); *Jacquemont,* ex Hb Montagne (G); Pto Famine, Hb Montagne as *J. capillaris* (PC); Port Gallant, *Cunningham 155 p.p.* (G); York Bay, *Lechler,* ex Hb Kew [sub *L. magellanica* G. (*L. neesii* var.)] (G-257); Mesham Cove, *Dr. Coppinger* (NY); St. Martin's Cove, *Davis,* ex Hb Taylor (NY); s.l., *d'Urville,* ex Hb Montagne & Ness *No. 354* (G), another, ex Hb Bescherelle "*Jungermannia capillaris Mont. 354*" (G), s.l., *Jacquemont 52,* ex Hb Bescherelle (as *L. blepharostoma*) [as *L. javanica*] (G); s.l., *Dusén 68* (G); Fuegia: s.l., *Dusén 53* (G-254), *59, 77, 265 p.p.* (G); s.l., *Skottsberg* (G); Laberinto I., *De Gasperi* (FI); Pto Sicurezza, *De Gasperi* (as *L. blepharostoma*) (FI); Cape Horn: s.l., *Davis,* ex Hb Hooker (NY); "Penguin Rookery", *Spegazzini,* ex Hb Massalongo (NY); Cape Horn, *Spegazzini* (as *L. blepharostoma*) (G); Hermite I., *Hooker* 13 (NY); Staten I., *Menzies,* ex Hb Kew. (isotypes, G, G-255), *Spegazzini 41 –,* ex Hb Montagne (G-258), without collector, ex Hb Hooker (G); Hoste I., Harding Peninsula, Orange Bay, [Chilean ship "Yelcho"], *Chelminski 1, 3 p.p., 16, 18, 20 p.p. 30 p.p.* (Hb Fulford).

FALKLAND ISLANDS: s.l., *Lyall* [Ship Terror], ex Hb Kew (G); *"Crypt. Falkl." 9, 67* (as *J. tetradactyla*) (NY); nw Bay, *Skottsberg 42* [1907] (as *L. blepharostoma* (G); Pto Stanley, *Skottsberg* [1907] *165, 197c, 198* (G).

Additional reports of the species from Patagonia—Tierra del Fuego include Arnell (1957), Evans (1898), Gola (1923), Herzog (1942a, 1954, 1957, 1960), Kühnemann (1949), Massalongo (1885, 1927), Montagne (1945a, 1852), and Stephani (1900a, 1900b, 1901a, 1905, 1911).

The species also occurs in New Zealand (s.l., *J. Hooker,* as *J. tetradactyla,* NY), and is still another example of the Antarctic pattern of distribution.

There was much confusion as to the identity of the earlier collections of both *T. tetradactyla* and *T. plumulosa,* as is indicated in part by the synonymy under those species. The names *L. neesii* and *Jungermannia* (*Lepidozia*) *javanica* are of frequent occurrence in the early literature. It was recognized later that *L. javanica* Montagne was identical with *J. plumulosa.* The plants labeled *L. neesii* from South America which I have examined belong to *T. tetradactyla* or *T. plumulosa* and I have seen no plants of *L. neesii* from this area. The species *Telaranea neesii* (Lindenberg) Fulford is readily distinguished from both *T. tetradactyla* and *T. plumulosa* in that in the underleaves the lamina is two rows of cells high, the cuticle is conspicuously striolate, and the long cilia of the female bracts and bracteoles and the perianth mouth have one or more short branches or spines. Pl. 53. Fig. 7, a, b.

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————. 1924. Spec. Hep. **6:** 319–346. [*Lepidozia*]

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Psiloclada Mitten, in Hooker, Fl. N. Zeal. **2:** 143. t. 99, *f. 4.* 1855.

Plants small, slender, pinnate, the lateral branches leafy, often becoming flagelliform in the outer part, of the *Frullania* type with the dorsal half-leaf bifid or quadrifid, the ventral branches axillary, intercalary, leafy or flagelliform, or short sexual; stem in transverse section with a unistratose cortical layer of about 25 cells similar to those of the medulla. Line of leaf insertion curved, the dorsal half transverse, the ventral half oblique, the leaves succubous. Leaves subquadrate in outline, divided to one-half or two-thirds of their length into five or seven slender segments, for the most part consisting of a long hyaline tip cell at a right angle to the leaf and parallel to the stem or branch. Underleaves quadrifid (trifid), similar to the leaves. Plants dioicous; female inflorescence on a short ventral sexual branch, the bracts and bracteoles similar, in two or three series, different from the leaves, the bracts of the inner series deeply quadrifid. Male inflorescence, perianth, and sporophyte not seen.

Type species: *Psiloclada clandestina* Mitten.

The genus is known from South Africa, the Malayan Archipelago, Tasmania, and New Zealand. It does not occur in South America. The species which has been reported from South America is a *Microlepidozia.*

Lembidium Mitten, Handb. N. Zeal. Flora 758. 1867; emend. Herzog, Ark. Bot. II.**1:** 477. 1951.

Leafy stems turgid, ascending to erect, in tufts or scattered among other bryophytes (the American species), more or less radially symmetric from a closely branched rhizome system of flagelliform and stolon-like prostrate axes; branches ventral intercalary, as leafy stems, flagelliform branches, stolons or rhizomes. Leaves [American species] subquadrate to rectangular, bisbifid, or quadrifid, trifid, rarely bifid above, often of two layers of cells below. Underleaves similar, as large as the leaves or nearly so. Plants dioicous, the male and female inflorescences on short, erect, leafy branches from the rhizome or its branches. Male inflorescence terminal becoming intercalary, trigonous, the bracts and bracteoles similar, like small concave quadrifid leaves; antheridia in the axils of the bracts. Female inflorescence with three or four series of bracts and bracteoles like the leaves but increasing in size to the innermost series. Perianth cylindrical below, 3-keeled above, the keels rounded, inflated, the mouth contracted. Sporophyte not seen.

Type species: *Jungermannia nutans* Hooker & Taylor, London Jour. Bot. **3:** 389. 1844. [Auchland I.]

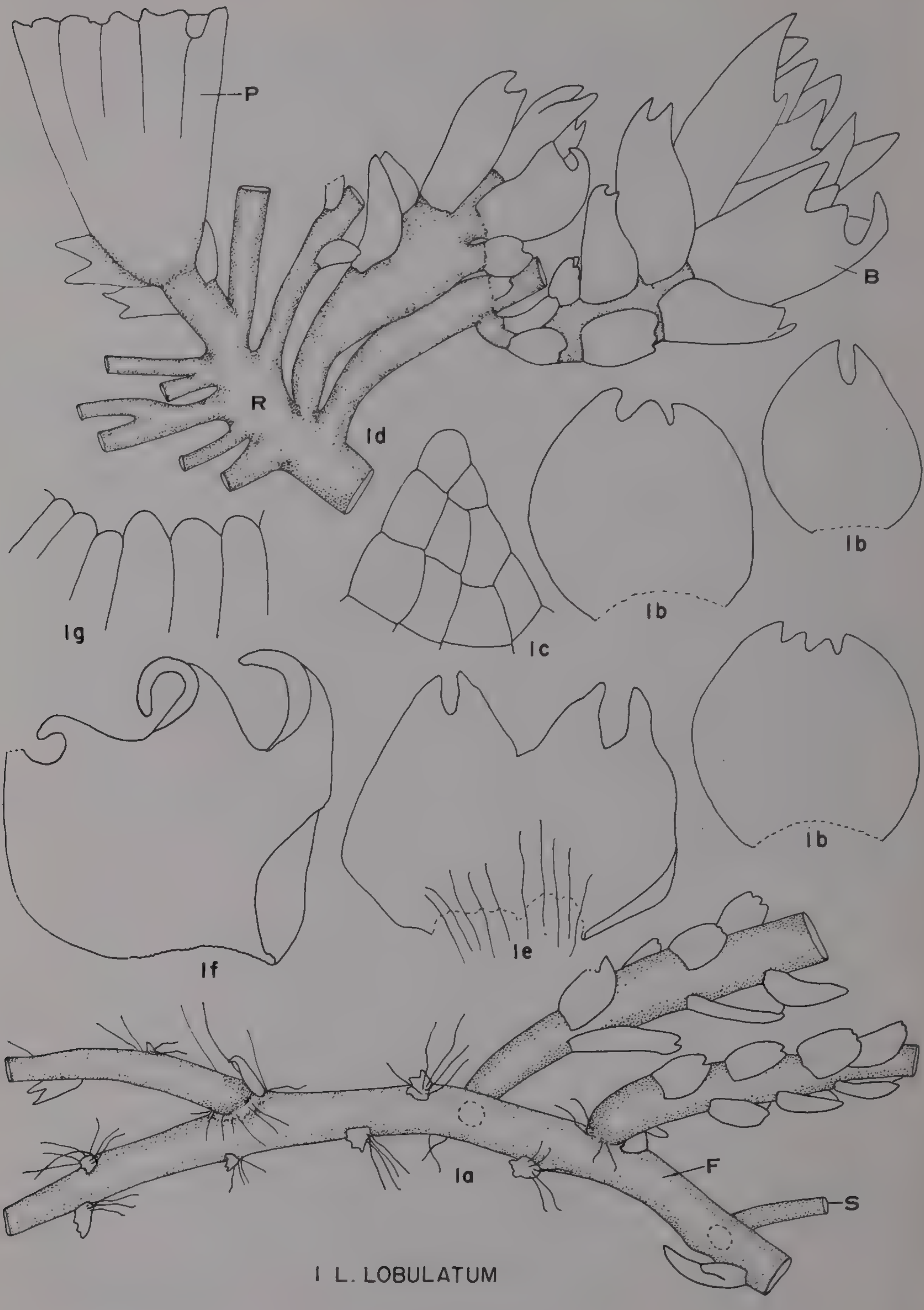
P
B
R
Id
Ig
Ic
Ib
Ib
Ib
If
Ie
Ia
F
S
I L. LOBULATUM

Plate 54

FIG. 1. *Lembidium lobulatum.* 1 a. Portion of a flagelliform axis with two leafy branches, × 75; F, flagelliform branch; S, stolon. 1 b. Leaves, × 133. 1 c. Cells of the tip of a segment, × 300. 1 d. A branched rhizome, R, with stolon-like and leafy branches; B, a female

Key to the Species

Leaves and underleaves of well developed stems tending to be conspicuously narrowed
at the four-lobed apex; ♀ bracts and bracteoles divided to one-third or one-half;
perianth mouth crenulate. 1. *L. lobulatum.*
Leaves and underleaves of well developed stems not usually so constricted; ♀ bracts
and bracteoles divided to one-fourth or less; perianth mouth of 12 short laciniae.
2. *L. quadrifolium.*

1. Lembidium lobulatum Herzog, Arch. Escuel. Farm. Fac. Ci. Méd. Córdoba **1938** (7): 24. f. 9. 1938.

Plants turgid, whitish green, in low dense tufts or among other bryophytes; leafy stems erect, to 1 cm long, radial or nearly so, slender, from a densely branched rhizome system, or from stolons, or flagelliform prostrate axes; branches from the leafy stems not seen, branches from the flagelliform and stolon-like axes numerous, intercalary from all three rows of scales, forming leafy branches or flagelliform or stolon-like axes. Rhizoids from the scales of flagelliform branches and often from the female branch. Stem in transverse section with a layer of cortical cells surrounding the medulla of similar cells. Line of leaf insertion transverse. Leaves distant to imbricate to 1 mm long, 0.8 mm wide, small on the lower part of the stem and increasing in size upward, ovate-truncate, orbicular or subquadrate in outline, bisbifid, quadrifid, trifid or bifid to one-sixth or less, the lamina often 2-layered below, the lateral margins entire to convex; segments short, broadly triangular, blunt to acute; leaf cells below the segments 20×40 μ, the walls thin, the trigones inconspicuous or absent, the cuticle smooth or nearly so. Underleaves like the leaves, on most stems as large as the leaves. Female inflorescence terminal on a very short leafy branch, the bracts and bracteoles in three or four series, the innermost series the largest, quadrifid to one-fourth or one-third the length. Perianth [only one seen] cylindrical below, 3-keeled above, the mouth contracted, crenulate. Male inflorescence and sporophyte not seen. Pl. 54. Fig. 1, a–g.

Habitat: Not given.

PATAGONIA: Corral a La Aguada, *Hosseus 59* (type, Hb Herzog; isotype G-1789).

2. Lembidium quadrilobum (Stephani) Fulford, comb. nov.

Isotachis quadriloba Stephani, Bihang, Sv. Vet.-akad. Handl. III. **26**^{6}: 54. 1900; Icon. Hep., *Isotachis No. 56/57.*

Isotachis granditexta Stephani, Sv. Vet.-akad. Handl. **49**^{9}: 68. *f. 26 c–e.* 1911; Icon. Hep., *Isotachis No. 54.*

Plants turgid, in whitish, pale or dull green, or brownish tufts, or scattered among other bryophytes; leafy stems slender, 0.5–3 cm long, erect or nearly so, sparingly branched, from an abundantly branched rhizome system, or arising from stolon-like or flagelliform axes with three rows of scale leaves; branches from the rhizome intercalary, ventral or lateral, erect leafy, or prostrate flagelliform or stolon-like and abundantly branched, leafy branches often showing a gradual transition in form and size of the leaves from scales to large leaves.

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inflorescence; P, a perianth; × 75. 1 e. Female bract of an intermediant series, with rhizoids from the lower half, × 133. 1 f. Female bract of the innermost series, × 133. 1 g. Cells of the mouth of the perianth, × 600.

Drawn from the original material.

Rhizoids abundant from the scale-leaves, the bases of some branches, and the base of the female inflorescence when on a very short branch; stem hyaline to pigmented with brown, in transverse section with a cortical layer of 12–24 rows of large cells surrounding the medulla of cells of similar size. Line of leaf insertion transverse. Leaves imbricate, variable in size even on one stem, subquadrate to longer than broad, 1.0–1.8 mm long, 1.0–1.6 mm wide, quadrifid, often bisbifid, to one-fifth of their length, or smaller and bifid or trifid, the lamina often 2-layered below, the margins entire, the segments triangular, acute to blunt; leaf cells of the segments and upper part of the leaf $35 \times 35\ \mu$, to $40\text{–}65 \times 35\ \mu$ in the lower part, or large throughout the leaf, the walls thin or uniformly thickened, the trigones small, conspicuous, the cuticle smooth or nearly so. Underleaves similar, sometimes a little smaller. Plants dioicous. Male inflorescence in terminal spikes or becoming intercalary, on short slender, erect branches with small, quadrate leaves and underleaves, trigonous; bracts and bracteoles in four or more series, small, suggesting small quadrate leaves with three or four short segments, very concave; antheridia single [?] in the axils of the bracts, large, whitish. Female inflorescence terminal on a short leafy branch from a rhizome or stolon, or a flagelliform axis, the bracts and bracteoles similar to the leaves in outline, in two to four series, the innermost series largest, quadrifid to one-sixth. Perianth to 4 mm long, cylindrical below, 3-keeled above, the mouth contracted, with to 12 lanceolate laciniae. Elaters bispiral; spores minutely verruculose, 18 μ in diameter. Sporophyte not seen. Pl. 55. Fig. 2, a–h.

Habitat: Abundant on peat mounds, occasionally on wood, in *Sphagnum* and *Polytrichum* bogs and *Sphagnum* moors.

PATAGONIA—TIERRA DEL FUEGO: 175–190 km along road from Punta Arenas to Natales. *Fulford 78 p.p., 82, 92, 93 p.p., 97, 99 p.p., 110a, 118b p.p., 119, 122, 246 p.p., 247 p.p., 248a, 249, 250, 269 p.p., 270 p.p., 281, 285* (Hb Fulford); Fuegia, *Dusén* [182] (type G-11102); Fuegia, *Halle* the type of *I. granditexta* (type G-3693), the same (G-2692). Fuegia, Lago Fagnano, *Halle 127* (UPS).

Additional localities are reported by Arnell (1955, 1958), Kühnemann (1949) and Stephani (1900a, 1901a, 1911).

References

Herzog, Th. 1951. Revision der Lebermoos Gattung *Lembidium* Mitt. Ark. Bot. II. **1:** 471–503. *f. 1–13.* [1952].

Schuster, R. 1963. Studies on Antipodal Hepaticae I. Jour. Hattori Bot. Lab. **26:** 185–309.

Micropterygium Lindenberg in G. L. & N., Syn. Hep. 233. 1845.

Leafy stems ascendent to erect from a prostrate, branched rhizome system, whitish to green, becoming light or dark brown, in mats or scattered among other bryophytes; stems simple or irregularly branched, the branches axillary, intercalary, lateral branches leafy, ventral branches leafy or flagelliform; in transverse section the stem with a cortical layer of 12 rows of slightly larger cells with thick, light to dark brown walls surrounding the medulla of usually colorless cells with thinner walls. Rhizome radial, with three rows of scale-leaves, branched, the branches intercalary, like the rhizome, or flagelliform, or erect radial, with three rows of small orbicular leaves and eventually becoming leafy, or leafy from the beginning. Rhizoids branched at the tips, colorless to brown, on the scale-leaves of the rhizome and the flagelliform branches. Line of leaf insertion transverse to slightly oblique, attached to four cells of the stem, the leaves equitant-imbricate. Leaves orbicular, broadly ovate, lanceolate to sub-

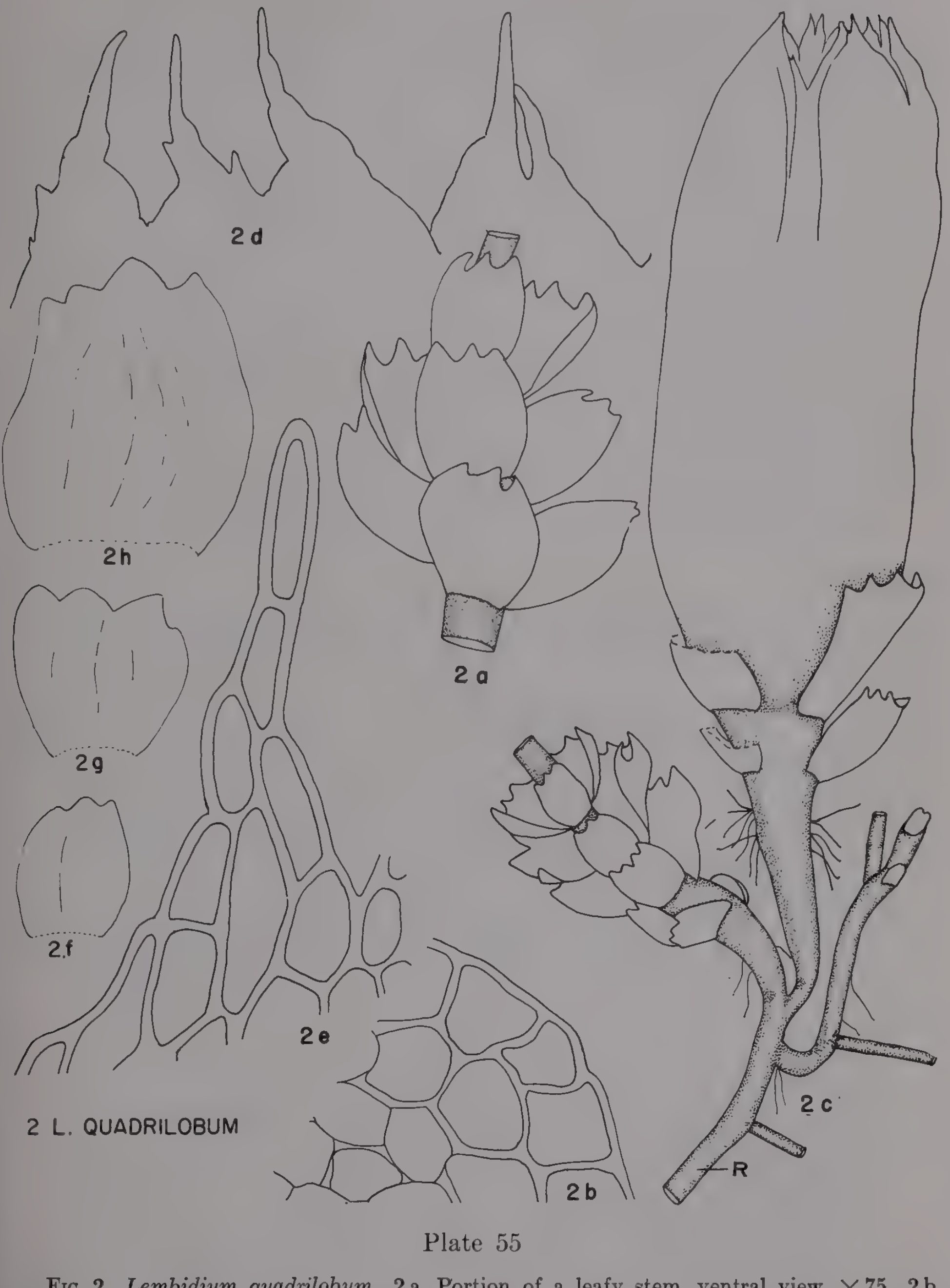

Plate 55

FIG. 2. *Lembidium quadrilobum*. 2 a. Portion of a leafy stem, ventral view, × 75. 2 b. Portion of a transverse section of a stem, × 300. 2 c. Portion of a plant with a perianth, × 75; R, stolon or rhizome. 2 d. Portion of the perianth mouth. 2 e. A lacinia of the perianth mouth, × 300; 2 f–h. Female bracts from the outer to the innermost series, × 25. Drawn from the type material of *L. granditexta*, 2 a–e; from the type, 2 f–h.

rectangular in outline, concave to complicate, the keel broad to sharply acute, a ventral wing from the keel absent or rudimentary, to large, three to five cells wide and extending from the apex to the middle of the leaf or beyond (in one species the wings in pairs), the lobes equal or the dorsal lobe larger, the margins entire, crenulate, serrate, dentate or incised; the cell surface (ventral) plane, or convex, or with a conspicuous mamillose projection, the cuticle smooth, verruculose, papillose or rough-warty. Underleaves similar to the leaves, or smaller, orbicular, ovate, long oval, quadrate, or of only a few cells, in some species showing a decrease in size from the base of the stem to the tip. Plants dioicous, the sexual branches ventral from near the base of the leafy stem, more rarely from the rhizome. Male inflorescence slender, short (very rarely terminal on the stem), usually catkin-like, hyaline, the bracts and bracteoles in four to ten series, smaller than the leaves and underleaves, the bracts concave, inflated, the bracteoles, small ovate, plane; antheridia one or two, in the axils of the bracts. Female inflorescence on a short sexual branch, without innovations, the bracts and bracteoles similar, in 3–4 series, different from the leaves, long ovate to ovate-lanceolate, toothed to laciniate-ciliate above. Perianth 4–6 mm long, terete below, trigonous and often with additional lobes above, the mouth contracted, three-parted and fringed with numerous cilia or ciliate laciniae Sporophyte capsule, long, red-brown. Spores small, red-brown.

Type species: *Jungermannia carinata* Greville, Ann. Lyc. Nat. Hist. N. Y. **1:** 276. 1825.

The genus is abundant in wet forests of tropical South America and extends southward into southern Brazil and northward into the West Indies. I have seen no specimens from Central America. Some of the species are restricted locally while others are widespread with seemingly several subspecies or varieties with distribution patterns which apparently overlap to some degree. Except for those species in which the stems with leaves tend to be radial the genus is readily recognized by the folded, flattened leaves with a conspicuous wing, and the flattened leafy stems from a prostrate rhizome system. Within the species there is a high degree of variability in size of leaves, configuration of the margin, length and width of the wing, size of the mamillose projections, and the smoothness or "wartyness" of the cuticle. The underleaves vary greatly in size and shape on any stem, and in certain species, characteristically show a gradual decrease in size from the base to the apex of the stem.

Key to the Species

1. Leafy stems more or less radially symmetric, underleaves large, little different from the leaves in size and form; a wing absent or poorly developed on the upper part of the leaf (in *M. steyermarkii* as long as the leaf).
  2. Leaves orbicular to broadly ovate; underleaves orbicular to ovate-truncate; plants tiny, slender.
    3. Leaf cells 9–12 μ, the cuticle smooth to faintly verruculose. 1. *M. surinamense.*
    3. Leaf cells 15–20 μ.
      4. Cells without mamillose projections, cuticle rough-warty. 2. *M. duidae.*
      4. Cells with very large mamillose projections, cuticle rought-warty. (small plants of) 11. *M. bolivarense.*
  2. Leaves ovate to lanceolate, acute to acuminate.
    3. Leaf cells mamillose; leaves and underleaves widely spreading, the margins crenulate-mamillose; the wing as long as the leaf. 16. *M. steyermarkii.*
    3. Leaf cells not mamillose, the cuticle smooth to faintly verruculose; a wing absent or short.

4. Leaves and underleaves acute to acuminate, usually widely spreading. 4. *M. grandistipulum.*
4. Leaves acute, the apices often decurved; underleaves rounded to ovate-truncate; leaf margins entire. 3. *M. tatei.*
1. Leafy stems clearly dorsi-ventral, often flattened; underleaves only to one-half the size of the leaves or smaller, rarely absent.
2. Leaf cells plane or scarcely convex on the outer surface; cuticle smooth, faintly to coarsely verruculose or warty.
3. Underleaves conspicuous, as broad or broader than the stem, scarcely decreasing in size to the tip of the stem.
4. Underleaves rounded, broader than the stem; leaves not conspicuously keeled; leaf margins undivided, crenulate by projecting cell walls; cells 10–13 μ. 17. *M. conchifolium.*
4. Underleaves longer than broad or if rounded, the apex conspicuously divided.
5. Leaves ovate-truncate to rectangular, keeled above but not conspicuously folded, the margins and wing incised-toothed; underleaves to twice as long as broad. 8. *M. leiophyllum.*
5. Leaves folded or sharply keeled throughout their length.
6. Leaf apex acute, the wing small, developed only in the upper part, or longer, the margins distantly serrate, and dentate; leaf cells 12–16 μ. 7. *M. reimersianum.*
6. Leaf apex blunt, rounded, the wing broad, the margins entire; leaf cells 15–18 μ. 10. *M. lechleri.*
3. Underleaves becoming smaller or absent toward the tip of the stem.
4. Margins of the leaf and wing entire or nearly so; leaves more or less equally folded.
5. Underleaves quadrate, not broader than the stem. 5. *M. carinatum.*
5. Underleaves usually of only a few cells; cells of the leaves and underleaves with large trigones with bulging sides; cell cavities angular rounded.
6. Cell surface covered with large, round to ellipsoidal warts. (Venezuela.) 18. *M. tumidulum.*
6. Cell surface verruculose. (Dominica, Cuba.) 6. *M. exalatum.*
4. Margins of the leaf and wing variously serrate, dentate and incised; the keel sharp, the wing long and broad, the ventral lobe small; leaf cells 15–20 μ. 9. *M. pterygophyllum.*
2. Leaf cells strongly convex, or with a single large mamillose projection conspicuous on the outer wall of most cells; cuticle smooth to verruculose or warty.
3. Leaves strongly concave, without a wing or with a wing of only a few cells on some leaves; cell mamillae very large, often nearly as broad as the cells. 11. *M. bolivarense.*
3. Leaves with one, or a pair, of well-developed wings along the keel.
4. Leaves with a well-developed *pair* of wings extending from the apex to the middle or beyond. 15. *M. bialatum.*
4. Leaves with a single unistratose wing extending from the apex to the middle of the leaf or beyond.
5. Underleaves large, conspicuous, present throughout the stem.
6. Leaves small, the margins entire, the wing only in the upper part; cells 10–12 μ. 12. *M. campanense.*
6. Leaves small to large, the margins serrate, dentate and incised, the wing conspicuous, long; cells 15–20 μ. 13. *M. trachyphyllum.*
5. Underleaves decreasing in size to the tip of the stem, often obscure.
6. Stems tiny, leaves short, concave, the wing small or rudimentary just below the apex (or absent). 11. *M. bolivarense.*
6. Stems larger, leaves complanate, elongate, the wing extending to the middle or below. 14. *M. parvistipulum.*

1. Micropterygium surinamense (Steph.) Reimers, Hedwigia **73:** 145. *f. 1.* 1933.

Lembidium surinamense Stephani, Spec. Hep. **6:** 445. 1924; Icon. Hep., *Lembidium No. 6.*

Leafy stems small, slender, brown, radially symmetric, more or less julaceous, ascending to erect from a branched rhizome, and forming cushions or mats, often with other bryophytes; stems 1–3 cm long, with leaves, to 0.5 mm broad, occasionally branched, the branches lateral and ventral, leafy; rhizome brown, with three rows of scale-leaves, the branches rhizome-like, flagelliform, or erect-leafy. Rhizoids abundant on the scale-leaves of rhizomes and flagelliform branches. Leaves and underleaves quite similar, erect-imbricate, concave, the base of four very large cells, similar to the four cortical cells of the stem to which they are attached. Leaves broadly orbicular-ovate, to 0.3 mm long, 0.45 mm broad, the very short tip blunt, the margins entire, a few-celled ventral wing sometimes present near the apex, a ridge-keel not developed; cells 9–12 μ across, the walls thickened, trigones small, the cuticle faintly verruculose. Underleaves similar, orbicular, concave, a wing never developed, cells as in the leaves. Male and female inflorescences and sporophyte not seen. Pl. 56. Fig. 1, a–c.

Habitat: In mats on moist substrate.

GUIANA: without locality, *Quelch* (type G-10917).

2. Micropterygium duidae Reimers, Hedwigia **73:** 147. *f. 2.* 1933.

Leafy stems small, slender, dull greenish to yellow-brown, appearing to be more or less radial, ascending to erect from a branched rhizome system, in dense cushions, often with other bryophytes; stems to 2 cm or more long, with leaves to 0.4 to 0.8 mm broad, lateral and ventral branches occasional, the ventral branches leafy or flagelliform. Rhizoids frequent on the bases of underleaves, the scale-leaves of the flagelliform branches, and the rhizome. Leaves ascendent, broadly ovate, deeply concave, 0.24–0.3 mm long, the apex acute, entire or bifid by a pair of cells, a ventral wing one or two cells wide often developed down the middle of the upper third or half, the margins usually entire, a row of four or eight large cells across the base; cells quadrate in outline, 15–20 μ, the walls uniformly thickened, the trigones inconspicuous, the cuticle weakly to coarsely papillose with numerous wart-like thickenings per cell. Underleaves similar to the leaves, a little smaller, orbicular, the apex broader, entire or undulate. Plants dioicous, the male and female inflorescences on short ventral sexual branches near the base of the stem. Male inflorescence inconspicuous, short, pale, catkin-like, the bracts in three to five pairs, concave, the bracteoles small, plane, ovate to shortly bifid. Female inflorescence conspicuous, the bracts and bracteoles in three series, ovate, the innermost bracts the largest, to 1.5 mm long, the upper margin long-ciliate. Perianth to 4 mm long, 3-angled, the mouth ciliate, the cells 0.2 mm long. Pl. 56. Fig. 2, a–c.

Habitat: In cushions or mats at the bases of moist sandstone escarpments, and on wet rocks, usually with *Aneura*.

VENEZUELA: Estado Bolívar: Chimantá Massif: sw edge of Apácara-tepuí, 1800–2000 m, *Steyermark 74981 p.p.* (NY); summit of Torono-tepuí, 2165–2180 m, *Steyermark & Wurdack 695 p.p., 704* (NY); island in Río Tirica, about Middle Falls, 1925 m, *Steyermark & Wurdack 465* ♀ (lectotype NY), *466* (NY). [Mt. Duida, 2130 m, *Tate 492* (the type, NY & B), cited by Reimers, 1933, but apparently lost.]; Roraima, *Ule 629* as *M. heterostipa* (G).

3. Micropterygium tatei Reimers, Hedwigia **73:** 150. *f. 3.* 1933.

Leafy stems, small, slender, greenish to yellow-brown, ascendent to erect from a branched rhizome system, appearing more or less radial, in cushions, often with other bryophytes; stems 1–2 cm long, with leaves to 0.3–0.5 mm broad,

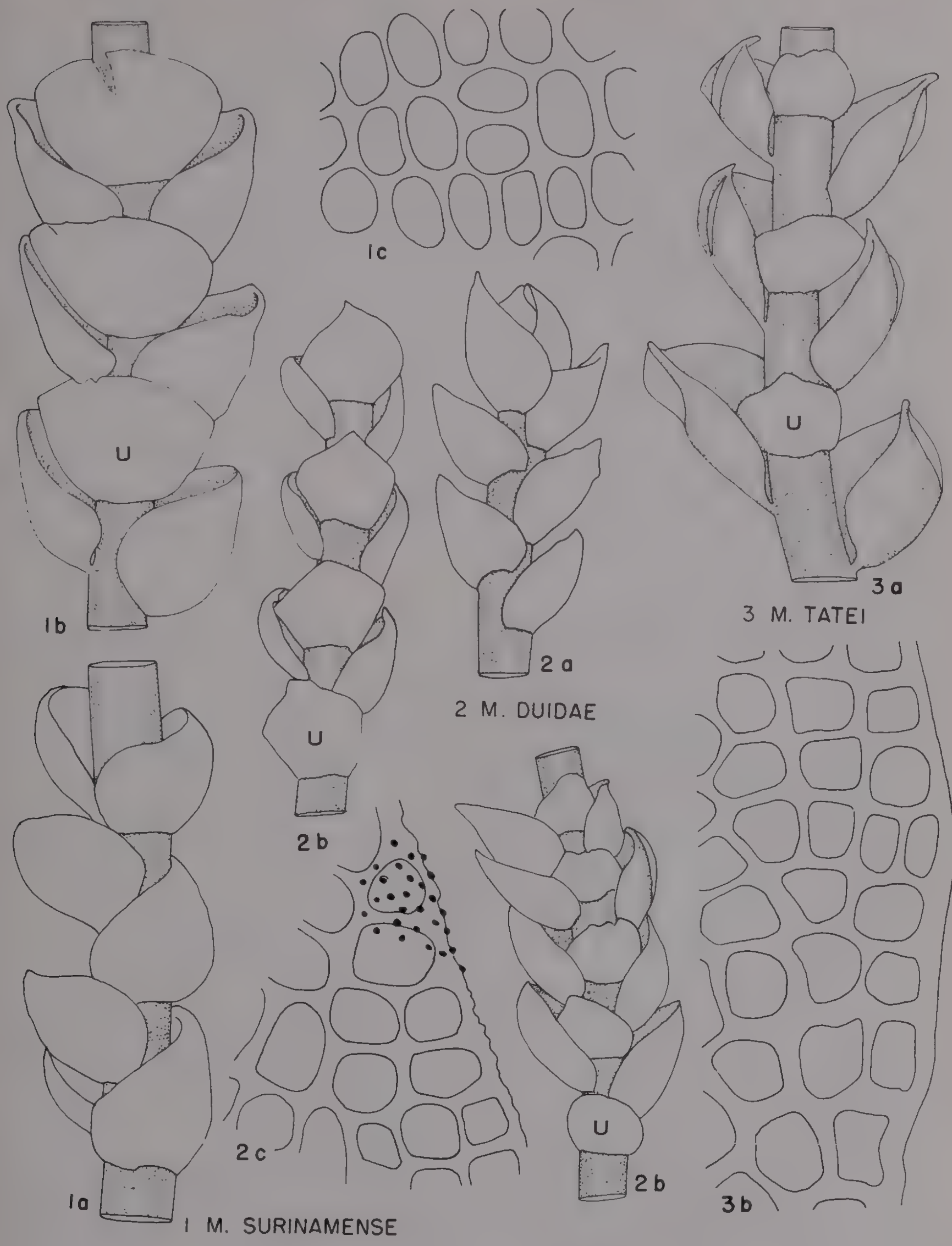
1c
1b
U
2a
2 M. DUIDAE
2b
U
3a
3 M. TATEI
U
3b
2c
2b
U
1a
1 M. SURINAMENSE

Plate 56

Fig. 1. *Micropterygium surinamense.* 1 a. Stem, dorsal view, × 75. 1 b. Stem, ventral view, × 75; U, underleaf. 1 c. Leaf cells, × 700.

Fig. 2. *M. duidae.* 2 a. Stem, dorsal view, × 75. 2 b. Stems, ventral view. × 75; U, underleaf. 2 c. Leaf cells from near the tip of a leaf, × 700.

Fig. 3. *M. tatei.* 3 a. Stem, ventral view, × 75; U, underleaf. 3 b. Cells from the dorsal side of a leaf near the tip, × 700. Figure 1 drawn from the type; figs. 2 and 3 from the lectotypes.

occasionally branched. Rhizoids frequent on the scale-leaves of the rhizomes, occasionally on the underleaves. Leaves more or less imbricate, ascendent, ovate, concave, the apex often curved as in *Loeskea*, a short wing often formed down the middle of the upper part, the margins entire; cells quadrate in outline, 10–18 μ, the walls uniformly thickened, trigones small, the cuticle smooth to faintly verruculose. Underleaves large, smaller than the leaves, concave, orbicular to truncate-ovate, never lanceolate, appressed to spreading, cells as in the leaves. Male inflorescence slender, hyaline, the bracts and bracteoles in five to seven series, bracts small, ovate, concave, bracteoles tiny, ovate; antheridia large, one or two in the axils of the bracts. Female inflorescence from near the base of a leafy branch, the bracts and bracteoles in three series, the innermost series long-ovate, 0.8–1.0 mm long, the upper part ending in two or three short cilia. Perianth and sporophyte not seen. Pl. 56. Fig. 3, a, b.

Habitat: On moist sandstone, rocks and ledges, and on twigs, usually in the spray of waterfalls in forests.

VENEZUELA: Estado Amazonas: Caño de Dios, 1900 m, *Maguire, Cowan & Wurdack 30271 p.p.* (NY); Río Cunucunuma, Cerro Huachamacari, 1400 m, *Maguire, Cowan & Wurdack 30332* (NY); Estado Bolívar: Chimantá Massif: Ptari-tepuí w of "Cave Rock", *Steyermark 59832* (F); e facing ss bluffs *Steyermark 59944* (F); Churi-tepuí, 2050 m, *Wurdack 34272* (lectotype NY). [Top of Mt. Duida, 2000 m, *Tate 519* ♀ (type NY, B) as cited by Reimers, p. 152, but apparently lost.]

4. Micropterygium grandistipulum Steph. Trans. Linn. Soc. II. Bot. **6:** 98. 1901; Icon. Hep., *Micropterygium No. 4.*

Leafy stems numerous, of small to medium size, appearing radial, greenish to yellow-brown, ascending to erect from a branched rhizome, in large mats or cushions, often with other bryophytes; stems 2–4 cm or more long, with leaves 0.8–1.5 mm broad, the leaves and underleaves widely spreading, leafy branches frequent, flagelliform branches numerous, from the axils of the underleaves. Rhizoids abundant on the scale-leaves of the flagelliform branches. Leaves widely spreading, approximate to imbricate, long ovate-acuminate, the tips sometimes recurved, somewhat concave, the keel broad, rounded, the wing narrow, two to four cells wide, extending from the apex to below the middle, the apex acute or of two pointed cells, the margins entire or with an occasional protruding cell; cells round-quadrate to rectangular, those of the apical part $15–20 \times 18\ \mu$, the walls equally thickened, the lumen rounded, trigones indistinct, the cuticle smooth to finely verruculose. Underleaves similar to the leaves or slightly smaller, without a wing, on less well developed stems often shorter. Plants dioicous, the sexual branches short, ventral, from near the base of the stem. Male inflorescence catkin-like, the bracts small, concave, hyaline, in three to five or more pairs, the bracteoles small, ovate; antheridia in pairs. Female inflorescence of three or four series of keeled bracts and bracteoles, bracts of the innermost series largest, divided to one-fourth of the length into four long-ciliate segments. Perianth to 6 mm long, of two to three layers of cells, three-keeled, the mouth contracted, long-ciliate, the cilia to 0.4 mm long. Pl. 57. Fig. 4, a–d.

Plate 57

FIG. 4. *Micropterygium grandistipulum.* 4 a. Stem, ventral view, × 45; U, underleaf. 4 b. Cells of the dorsal margin of a leaf near the apex, × 700. 4 c. Female inflorescence and perianth, × 75. 4 d. Male inflorescence [ventral-intercalary], dorsal view, × 75.

FIG. 5. *M. carinatum.* 5 a. Stem, ventral view, × 75; U, underleaf. 5 b. Cells of the dorsal lamina near the apex, × 700. 5 c. Portion of a transverse section of a stem, × 700. 5 d. Female inflorescence and perianth, × 45. 5 e. One of the cilia of the perianth mouth, × 300.

FIG. 6. *M. exalatum.* 6 a. Stem, ventral view, × 75. 6 b. Leaf cell, × 700.

Figures drawn from the types.

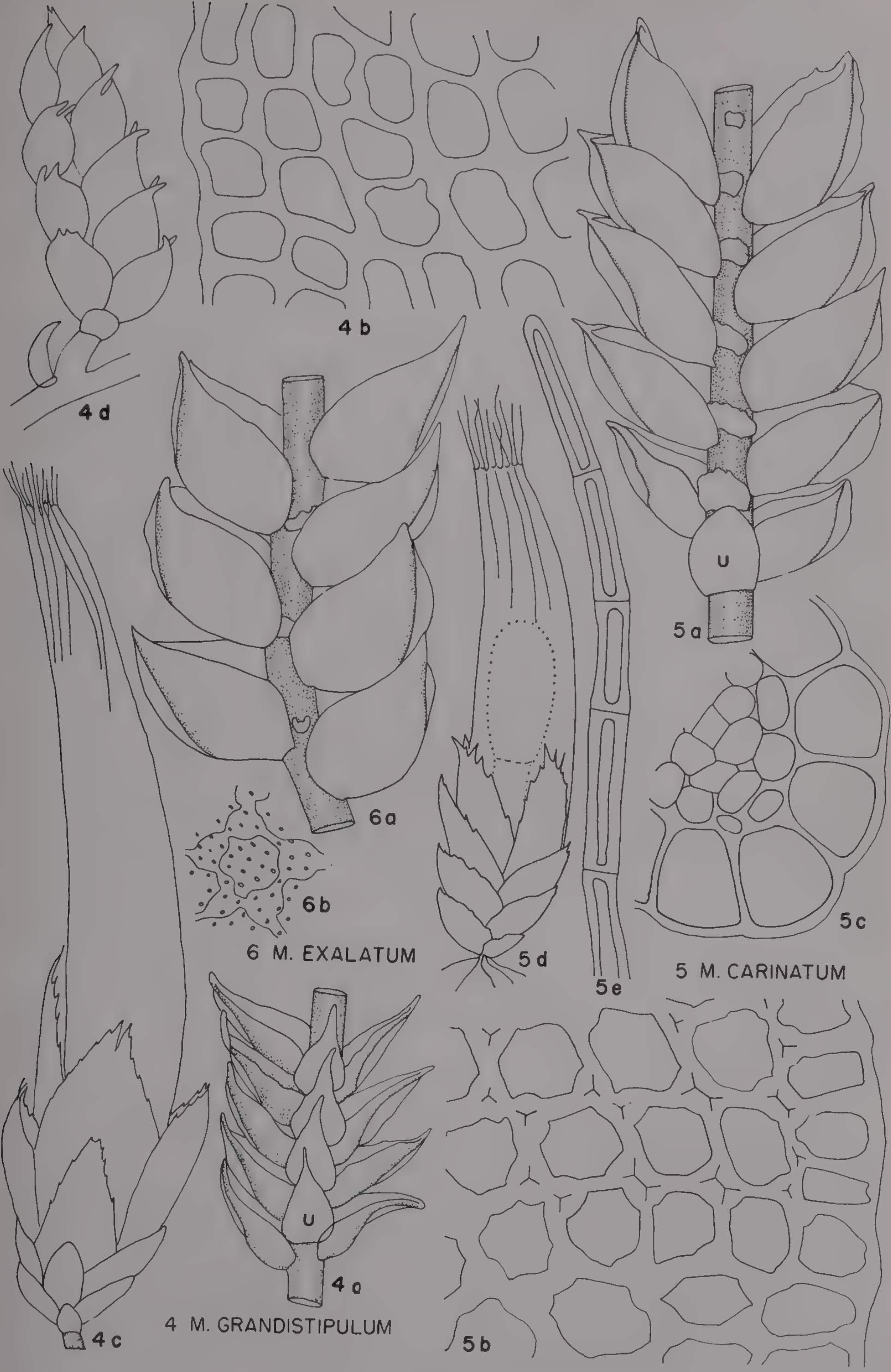
4 d
4 b
6 a
6 b
6 M. EXALATUM
4 c
4 a
4 M. GRANDISTIPULUM
5 d
5 e
5 a
5 c
5 M. CARINATUM
5 b
U

Plate 57

Habitat: On stems, or in cushions or mats, on moist sandstone rock faces and ledges, especially near waterfalls at elevations above 1500 m.

VENEZUELA: Estado Bolívar: Chimantá Massif, sw edge Apácara-tepuí, 1800–2000 m, *Steyermark 74981 p.p.* ♂ (NY); Torono-tepuí, 2165–2180 m, *Steyermark & Wurdack 695 p.p.* (NY); nw slopes, Churi-tepuí (Muru-tepuí), *Wurdack 34272 p.p.* (NY); Sarven-tepuí 1750–2000 m, *Wurdack 34106* ♀ (NY); island in Río Tirica, above Middle Falls, 1925 m, *Steyermark & Wurdack 465 p.p., 466* ♂ *p.p.* (NY); Cerro Venamo, ss escarpment, 1500 m, *Steyermark & Dunsterville 92593* (VEN); Auyan-tepuí, escarpment over El Peñon, 2200 m, *Steyermark 94037, 94039* (NY).

BRITISH GUIANA: without locality *Quelch* (type G-10868) [as "Guiana Gallica" —see Reimers, 1933, p. 155].

5. **Micropterygium carinatum** (Grev.) Reimers, Hedwigia **76:** 166. 1936.

Jungermannia carinata Greville, Ann. Lyc. Nat. Hist. N.Y. **1:** 276. *Pl. 23, f. 1–4.* 1825.
Jungermannia cymbifolia Hooker in Lehmann, Pug. Pl. **6:** 60. 1834.
Micropterygium cymbifolium (Hook.) Nees, Lindenberg & Gottsche in G. L. & N. Syn. Hep. 234. 1844.
Micropterygium portoricense Stephani, Hedwigia **27:** 294. 1888; Icon. Hep., *Micropterygium No. 8.*

Leafy stems numerous, from a branched rhizome system, small yellow-green to yellow-brown, prostrate to ascending, usually forming compact mats; stems 1–2 cm long, with leaves 0.8–1 mm broad, flattened, lateral branches frequent, ventral flagelliform branches occasional; stem in transverse section of a cortical layer of 12 large cells, 20–24 μ in diameter surrounding the medulla of many smaller cells. Rhizoids in tufts from the scale-leaves of the rhizome and the flagelliform branches. Leaves closely imbricate, spreading with the outer part erect or decurved, 0.5–0.7 mm long, broadly ovate, concave, obtusely keeled, the wing of two to four rows of cells, extending from the tip to the middle or below, the apex acute, the margins and the wing entire or with an occasional projecting cell; cells of the apical portion quadrate-rounded, 15–20 μ, the walls thickened, trigones distinct, the cuticle smooth to roughened, verruculose. Underleaves small, scarcely as broad as the stem, rounded to rectangular with the apex variously lobed or toothed, usually decreasing in size toward the tip of the stem. Plants dioicous, the short sexual branches ventral, on the lower part of a leafy stem. Male branches catkin-like, hyaline or brownish, the bracts very small, in three to ten pairs, concave, ovate, acute to bifid, the bracteoles small lanceolate. Female branches very short, the bracts and bracteoles keeled, in three series, the innermost bracts to 2 mm long, long ovate, the margin of the upper part with occasional short cilia. Perianth to 3 mm long, three-keeled above, the mouth contracted, ciliate with cilia 0.8–1.2 m long. Spores and sporophytes not seen. Pl. 57. Fig. 5, a–e.

Habitat: On twigs and branches, logs and sometimes on rocks in forests.

PUERTO RICO: Canovanas, *Pagán 372* (Y), *384* (NY); Caño de la Punta, *Steere 6436* (NY, Hb Fulford); Mt. Britton, *Steere 4275* (NY, Hb Fulford); Sierra Naguabo 465–720 m, *Shafer 3751* ♂ (NY, Y), *3776a* (NY, Y); El Yunque, *Shafer 3775 p.p.* (NY, Y), *3776 p.p.* (Y), *3776a* (NY), *Evans 9* (Y), *50 p.p.* (NY, Y), *53* (NY, Y, US), *53a* (Y), *115* (BM, NY, Y); *Pagán 516* (NY, Y); *Steere 4132, 4133* (NY, Hb Fulford); without locality, *Schwanecke*, type of *M. portoricenses* (BM); without locality, *Sintenis* (BM).

GUADELOUPE: Deshayes, *Duss 84* (NY); Galion, *P. & V. Allorge* (BR, PC, US); Morne Hirondelle, *Duss 138, 157* (NY); Ravine-Chaude, *Duss 297* (NY); Matylis, 1200 m, *Questel 3831* (Hb. *Questel*); without locality, *Dr. Madianna* Hb. Greville (type, NY); without locality, without collector, as *J. cymbifolia*, probably a portion of the type of *J. cymbifolia* (NY); Lamentin, *Duss 277* (NY); without locality, *Duss 78* (NY), *84* (NY, Y); without locality, *l'Herminier* (BM); without locality, *Parker* (NY).

DOMINICA: Boiling Lake, *Miss Noel 29* (Y); Morne Diablotin, *Elliott 664, 667* (BM); Morne Micotrin, *Elliott E1040, 104, 1157* (BM); Soufrière, *Elliott 819a, 845* ♀ (BM); Morne Trois Pitons, *Elliott 2251a* (BM).

MARTINIQUE: Mt. Pelée 600–1200 m, *Duss 159, 277* ♀ (NY).

VENEZUELA: Estado Amazonas: summit, Cerro Duida, *Steyermark 58383a p.p.* (F); Estado Bolívar: summit Torono-tepuí 2165–2180 m, *Steyermark & Wurdack 704 p.p.* (NY).

The above records from South America are the first for the species outside of the West Indies. These specimens are like the type from Guadeloupe except that they are slightly larger.

6. **Micropterygium exalatum** Stephani, Spec. Hep. **3:** 547. 1909; Icon. Hep., *Micropterygium No. 3.*

Leafy stems numerous, from a branched rhizome, small, yellow-brown, prostrate in compact mats; stems flattened, 0.5–1 cm long, with leaves 0.4–0.6 mm broad, often branched and with frequent ventral flagelliform branches. Rhizoids on the scale-leaves of flagelliform branches. Leaves closely imbricate, short, broadly ovate, strongly concave, curving upward in the outer part, 0.4–0.5 mm long, keeled, with a narrow wing in the upper part, the margins entire; cells of the apical portion round-quadrate, 18–20 μ, the walls thickened, trigones large with convex sides, the cuticle verruculose. Underleaves decreasing in size from the base of the stem upward, often of only a few cells. Plants dioicous, the sexual branches short ventral, basal on the leafy stem. Male branches very short, the bracts in three pairs, darker, the cells large, the bracteoles narrow. Female inflorescence short, the bracts and bracteoles in three series, the innermost bracts to 0.8 mm long, the apex with two or three short cilia. Perianth not seen. Pl. 57. Fig. 6, a, b.

Habitat: On tree bark and decayed wood.

PUERTO RICO: El Yunque, *Evans 50 p.p.* ♂, *53a p.p.* (Y).

DOMINICA: without locality, *Elliott* ♀ (type, G-10866), *Elliott* (G-10867), *Elliott 1936 p.p.* (BM); Morne Microtrin, *Elliott 1092a* ♂ *p.p.* (BM).

The plants cited above have much in common with *M. carinatum* particularly those plants of more xerophytic situations, but the species is readily distinguished by the compact arrangement of the leaves and the very small, few-celled underleaves in the upper part of the stem.

7. **Micropterygium reimersianum** Herzog, Hedwigia **81:** 226. *f. 1.* 1944.

Leafy stems of small to medium size, light yellow-green to yellow-brown, ascendent to erect from the branched rhizome, in large mats, often among other bryophytes; stems lax, flattened, 2–3 cm long, with leaves 1.0–1.5 mm broad, often pinnately branched, leafy branches lateral, rarely ventral, flagelliform branches ventral, infrequent. Rhizoids on the scale-leaves of the flagelliform branches. Leaves spreading, becoming erect to decurved in the outer part, more or less imbricate, concave, asymmetrically ovate, to 1 mm long, a wing three to five rows of cells wide conspicuous on the upper half or more, the apex acute or notched, the margins distantly serrate, sometimes dentate; leaf cells quadrate to angular, 10–16 μ, the walls uniformly thickened or with small trigones, the cuticle faintly verruculose. Underleaves large, orbicular, broader than the stem, concave, the margins entire or with occasional projecting cells or teeth in the upper part. Male inflorescence with the bracts and bracteoles in four to six series, the bracts concave, acute with the tip curved outward, the margins toothed above, the bracteoles small, plane. Female bracts and bracteoles long-ovate, long laciniate-ciliate above. Perianth to 3.5 mm long, the mouth laciniate-ciliate with very long cilia. Sporophyte not seen. Pl. 58. Fig. 7, a–c.

Habitat: On moist cliffs, rocks and banks, in spray of waterfalls, and on trees, forests.

VENEZUELA: Estado Amazonas: Río Orinoco, Cerro Yapacana, Cumbre, 1200 m, *Maguire, Cowan & Wurdack 30701* (NY); Serrania Parú, Río Parú, Caño Asisa, 1800 m, *Cowan & Wurdack 31316, 31430* (NY), Estado Bolívar: Chimantá Massif, Abácapa-tepuí, 1200–1600 m, *Steyermark 75150* (NY); between S. Teresita de Kavanayen and Kavanayen, 1200 m, *Steyermark 60478* (F); Peñon, Oriyarn-tepuí, 1800 m, *Vareschi* 4803 (VEN).
BRAZIL: Bahia: Rio das Contas, 600 m, *Lützelburg 1913* (type, Hb Herzog).

8. Micropterygium leiophyllum Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 386. 1885.

Jungermannia pterygophyllum Nees *p.p.* in Martius, Fl. Bras. **1**(1): 377. 1833; in Martius, Icon. plant. brasil. p. 34 [excl. t. 19] 1828–1834.

Herpetium pterygophyllum Nees ms.

Micropterygium vulgare Nees, Lindenberg, Gottsche var. *α p.p.* in G. L. & N. Syn. Hep. 234. 1844.

Micropterygium pterygophyllum (Nees) Trevisan *p.p.*, Mem. Ist. Lomb. III. **4:** 413. 1877.

Leafy stems of medium size, yellowish green, ascendent from a branched rhizome, in loose tufts or mats; stems 3–4 cm long, with leaves, to 1.5 mm broad, simple to bipinnately branched, sometimes becoming flagelliform above, ventral flagelliform branches frequent. Rhizoids brown, in tufts from scale-leaves of the flagelliform branches and the rhizome. Leaves spreading, imbricate, often undulate when dry, more or less open-plane below, ovate-truncate to rectangular in outline, to 0.8 mm long, 0.4 mm broad at the middle, concave and with a broad keel and a wide, conspicuous wing above, the dorsal lobe twice as broad as the ventral, the apex open, broad, truncate, the margins and wing coarsely dentate-serrate; cells of the upper part mostly quadrate, 18–20 μ across, the walls equally thickened, trigones inconspicuous, the cuticle smooth to faintly verruculose. Underleaves large, conspicuous, mostly broader than the stem, longer than broad, ovate to rectangular, the apex with two to four triangular teeth three to seven cells long, the margins entire. Plants dioicous, the short sexual branches near the base of a leafy stem. Male branches long, flaccid, slender, catkin-like, hyaline or tinged with brown, the bracts in to 16 pairs, short-ovate, concave, squarrose above, the apex of two long cells, the bracteoles plane, like the underleaves, smaller. Female branches very short, the bracts and bracteoles long, keeled below, in three or four series, the innermost series to 1.5 mm long, ovate, the upper part divided into two or three, toothed segments. Perianth to 4 mm long, three-keeled with additional folds above, the mouth contracted, long laciniate-ciliate, the cells long. Spores red-brown, 10–12 μ, faintly verruculose. Pl. 58. Fig. 8, a–d.

Habitat: On logs, trunks of trees, rocks, rarely over soil, in forests at elevations usually below 500 m.

Plate 58

FIG. 7. *Micropterygium reimersianum.* 7 a. Stem, dorsal view, × 75. 7 b. Stem, ventral view, × 75. 7 c. Cells of the dorsal margin of a leaf near the apex, × 700.

FIG. 8. *M. leiophyllum.* 8 a. Stem, ventral view, × 75. 8 b. Cells of the dorsal margin of a leaf near the apex, × 700. 8 c. Portion of a female bract, innermost series, × 75. 8 d. One of the laciniae of the perianth mouth, × 300.

Figure 7 drawn from the type.

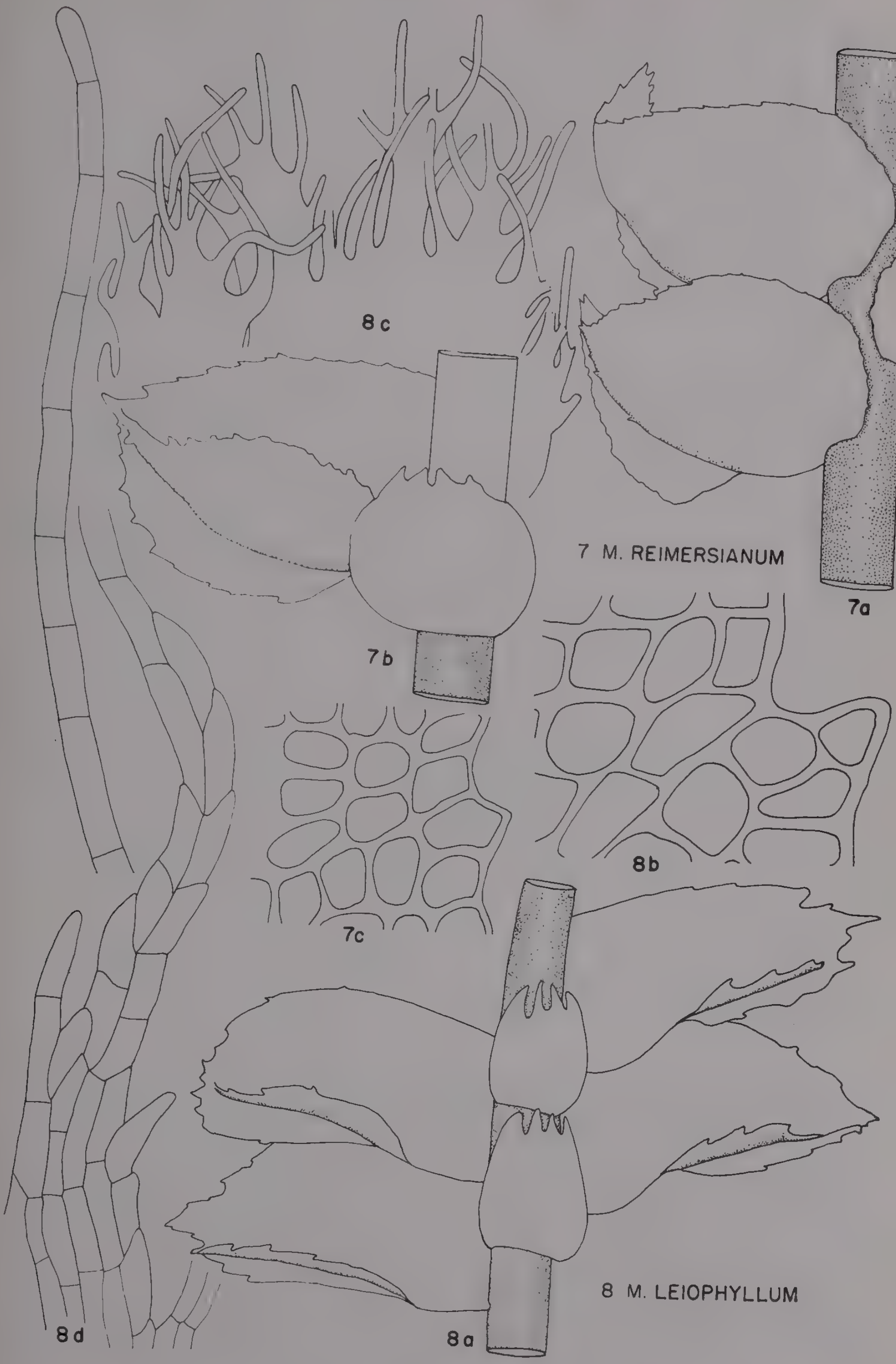
8c
7 M. REIMERSIANUM
7a
7b
8b
7c
8 M. LEIOPHYLLUM
8d
8a

Plate 58

COLOMBIA: Amazonas—Vaupés: Río Apaporis, 250 m, *Schultes & Cabrera 11975* ♀ ♂, *12345* (FH); mouth of Río Pacoa, *Schultes & Cabrera 12542* (FH); Soratama, 250 m, *Schultes & Cabrera 15130, 15144* (FH); Raudal Yayacopi, 250 m, *Schultes & Cabrera 15437* ♂ (FH); Jinogojé, 200 m, *Schultes & Cabrera 16586* (FH); Amazonas: Río Miritiparaná, Caño Guacayá, 200 m, *Schultes & Cabrera 15790* ♀, *16546, 16547, 16550* ♀, *16555 p.p.* (FH); Río Caquetá, La Pedrera, *Schultes & Cabrera 17811* ♀, *17818* (FH); Vaupés: Río Kananarí, Caohivera Palito, 250 m, *Schultes & Cabrera 13114* ♀, *13196* (FH); Río Kuduyarí, Cerro Yapobodà, 450 m, *Schultes & Cabrera 14185* ♂ (FH); Río Paca, Wacaricuara, 195 m, *Schultes & Cabrera 19508* (FH); Río Papury, Teresita, *Schultes & Cabrera 19456* ♀, *19459 p.p., 19462* (FH); Río Vaupés, Cerro de Mitú, 250 m, *Schultes & Cabrera 13859* ♀, *13875* ♀ (FH).

VENEZUELA: Amazonas: Río Orinoco, Cerro Yapacana, Cumbre, 1200 m, *Maguire, Cowan & Wurdack 30700* (NY); near Culebra, 200 m, *Maguire, Cowan & Wurdack 30418* (NY); Río Negro, near Piedra Cucuy, 100 m, *Maguire & Wurdack 34936* (NY). Estado Bolívar: Cerro Duida, Caño Negro, 200–260 m, *Steyermark 57825a, 58096* (F) S. Carlos, *Spruce 37* (NY); Sierra Ichún, 625–725 m, *Steyermark 90209* (VEN), same locality, 500 m, *Steyermark 90388* (VEN).

BRAZIL: Rio Amazon, as *H. pterygophyllum,* Hb *Nees* (STR), the same, (BR); Rio Negro, (Tarumá et Cocuí) *Spruce, Hep. Spruc.* as *M. leiophyllum* var. (BR, NY, US, Y); Caripi et Tanau prope Pará, *Spruce, Hep. Spruc.* (isotype BR, NY, US, Y); S. *Gabriel, Spruce, Hep. Spruc.* (US); in Caatinga, *Spruce* (NY); Rio Negro, *Spruce* (NY, US); Rio Negro, S. Felippe, *Lützelburg, 22360, 22386* (Hb Herzog); Prov. Amazonas, *Traill* (NY); Tanau, *Spruce* (NY); Rio de Janeiro, *Glaziou 9260* (NY); Rio Negro, Caatinga do Ticundari, *Sioli 13, 15* (Hb Herzog), Rio Papori, Trinidade, *Lützelburg 23010 b* (Hb Herzog); Rio Uaupés, Jutica, Campos, *Lützelburg, s.n.* (Hb Herzog); Rio Uaupés, Jutica, Varadouro, *Lützelburg 23749* (Hb Herzog); "flumen Amazonas," Hb. Nees, as *Herpetium pterygophyllum* *α* (STR); "Brasilia," Hb. Nees, as *Herpetium pterygophyllum* (STR); "Flumen Amazonium," *Martius* (type, M); without locality, *Martius,* with *M. pterygophyllum* (M); Rio de Janeiro: (leg. *Martius* or *Sellow?,* fide Reimers), with *M. pterygophyllum* (M).

PERU: Campana, *Spruce* (NY).

BOLIVIA: S. Carlos bei Mapiri, 850 m, *Buchtien 275 p.p.* (Hb Herzog).

The species has also been reported from Brazil by Ule (Stephani, 1905) and from Bolivia by Müller (1955).

9. **Micropterygium pterygophyllum** (Nees) Trevisan, Mem. Ist. Lomb. III. **4:** 413. 1877; emend. Reimers, Hedwigia **73:** 174. *f. 12, 13, 15 4–6.* 1933. Not. *M. pterygophyllum* (Martius) Spruce, 1885.

Jungermannia pterygophyllum Nees *p.p.* in Martius, Fl. Brasil. **1**(1): 377. 1833; *p.p.* in Martius, Icon. plant. brasil. p. 34. 1828–1834. [Quoad t. 19].

Micropterygium vulgare Nees, Lindenberg & Gottsche var. *α p.p.,* in G. L. & N. Syn. Hep. 234. 1844. [as synonym.]

Micropterygium parvistipulum var. *lancifolium* Spruce *p.p., Hep. Spruc.*

Micropterygium martianum Stephani, Hedwigia **27:** 295. 1888. [as synonym.]

Micropterygium pterygophyllum var. *gracile* Reimers, Hedwigia **73:** 176. *f. 13.* 1933.

Micropterygium pterygophyllum var. *lancifolium* (Spruce) Reimers, Hedwigia **73:** 176. *f. 15, 4–6.* 1933.

Micropterygium pterygophyllum var. *robustum* Reimers, Hedwigia **73:** 175. 1933.

Leafy stems of medium to large size, pale yellowish-green to brownish, complanate, ascendent from a branched rhizome, in tufts or mats; stems to 1.5–2 cm long, with leaves to 1.2 mm broad, simple or occasionally branched, sometimes becoming flagelliform at the tips, ventral flagelliform branches occasional. Rhizoids often brown, long with branched tips, in tufts on the scale-leaves of the rhizome and the flagelliform branches. Leaves spreading, subimbricate, complicate, to 0.5 mm long, flattened, the keel distinct, the wing large, four to six rows of cells high, extending to near the base of the leaf, the dorsal lobe somewhat larger than the ventral, the apex usually acute, the margins of the leaf and wing obscurely serrate and with few to many larger teeth; leaf cells of the upper part quadrate, 15–20 μ across, cells of the wing adjacent to the keel elongate, to 27×15 μ, the walls thickened, trigones conspicuous, the cuticle roughly verruculose. Underleaves decreasing in size to the tip of the stem, below broadly ovate and broader than the stem, above becoming very small and narrower than the stem, often 2- to 4-lobed or toothed. Plants dioicous, the short sexual branches from near the base of the leafy branches, the male branch sometimes on a flagelliform branch. Male inflorescence robust, nearly as broad as the leafy stem, the bracts and bracteoles in five to ten series, the bracts ovate, concave, the tip 2- or 3-celled, bracteoles plane, ovate; antheridia in pairs. Female bracts and bracteoles in three series, the innermost bracts 1.0–1.5 mm long, ovate, ciliate-laciniate above. Perianth to 5 mm long, the mouth 3-lobed and ciliate-laciniate with long cilia. Pl. 59. Fig. 9, a–c.

Habitat: On trees, logs, sandstone rocks, and soil, along streams and on cliffs near waterfalls in the rain forest.

COLOMBIA: Amazonas—Vaupés: Río Apaporis, 250 m, *Schultes & Cabrera 11919, 12394* ♀ (FH); Cachivera de Jirijirimo, 250 m, *Schultes & Cabrera 12341, 12395, 12398* ♀, *12405* (FH); nr Río Pacoa, 250 m, *Schultes & Cabrera 12433, 12533, 12543* (FH). Vaupés: Río Kuduyari, Yapoboda, *Schultes & Cabrera 14304* (FH); Río Vaupés, Mitú, 250 m, *Schultes & Cabrera 13879* ♀ (FH); Río Piraparaná, *Schultes & Cabrera 15902* ♀ (FH); Río Tuí below Raudal del Yurupari, *Schultes & Cabrera 14417* (FH).

VENEZUELA: Estado Amazonas: nr Cerro Duida, Caño Negros, 250 m, *Steyermark 57825a p.p.* (F); Cerro Venamo, e tributary of Río Venamo, 950 m, *Steyermark & Dunsterville 92228 p.p. 92630* (VEN); Casiquiare, Laja da Caraça *Lützelberg 22881a, 22882a* (Hb Herzog); Río Cunucunuma, Cerro Huachamacari, 1200 m, *Maguire, Cowan & Wurdack 29915, 29925* ♂ (NY). Estado Bolívar: Sierra Ichún, 625–726 m, Steyermark 90248 (VEN).

BRAZIL: Amazonas, *Traill* (NY); Rio Negro, S. Gabriel, *Spruce, Hep. Spruc.* (BR, NY); Bana. de Rio Negro, *Spruce* (NY); Rio Negro, S. Gabriel, *Spruce, Hep. Spruc.* (some packets of *M. parvistipulum* var. *lancifolium* where the leaf cells lack mamillae) (NY); Rio Negro, *Spruce* (NY); selva Amazonis (Rio Negro), *Spruce* (NY); Rio Uaupés, Juticá, *Lützelberg, 23624, 23800* (Hb Herzog); Rio de Janeiro, [“*Martius* or *Sellow*,” fide Reimers] with *M. leiophyllum* (M); without locality, *Martius*, (mixed with *M. leiophyllum* (type (?)M)

The species is also cited from Guadeloupe and Martinique, collected by Duss (Stephani, 1904) and from British Guiana, collected by McConnell and Quelch (Stephani, 1901–1905). Most of the plants from Guadeloupe and Martinique have low mamillae on the cells and are included under *M. trachyphyllum*. Plants of certain packets collected by Spruce in S. Gabriel and distributed as *M. parvistipulum* var. *lancifolium* in the *Hepaticae Spruceana* have very low mamillae or only convex or even plane cell walls. I have considered these plants as *M. pterygophyllum* while the plants of similar aspect and habit, but with mamillose projections on the leaf cells are cited under *M. parvistipulum*.

10. **Micropterygium lechleri** Reimers, Hedwigia **73:** 184. f. 14. 1933.

Micropterygium angustistipulum Spruce in Stephani, Spec. Hep. **3:** 545. 1909; Icon. Hep., *Micropterygium No. 1.* Not *M. angustistipulum* Spruce, 385. 1885.

Leafy stems of medium to large size, light yellowish green to brownish, complanate, erect with recurved tips, from a prostrate, branched rhizome, and forming dense tufts or mats; stems 1–2 cm long, with leaves to 1.5 mm wide, simple to pinnately branched; ventral flagelliform branches infrequent; rhizoids colorless, long, branched at the tips, in tufts on the scale-leaves of flagelliform branches and the rhizome. Leaves spreading, loosely imbricate, ovate, concave, flattened, to 1 mm long, keeled, with a broad wing from the apex to near the base, the dorsal lobe wider than the ventral, the apex obtuse, blunt or rounded, the margins of the leaf and wing entire; leaf cells quadrate to longer than broad, 12–15 μ, the walls uniformly thickened, trigones small to inconspicuous, the cuticle rough-verruculose. Underleaves large, squarrose, wider than the stem,

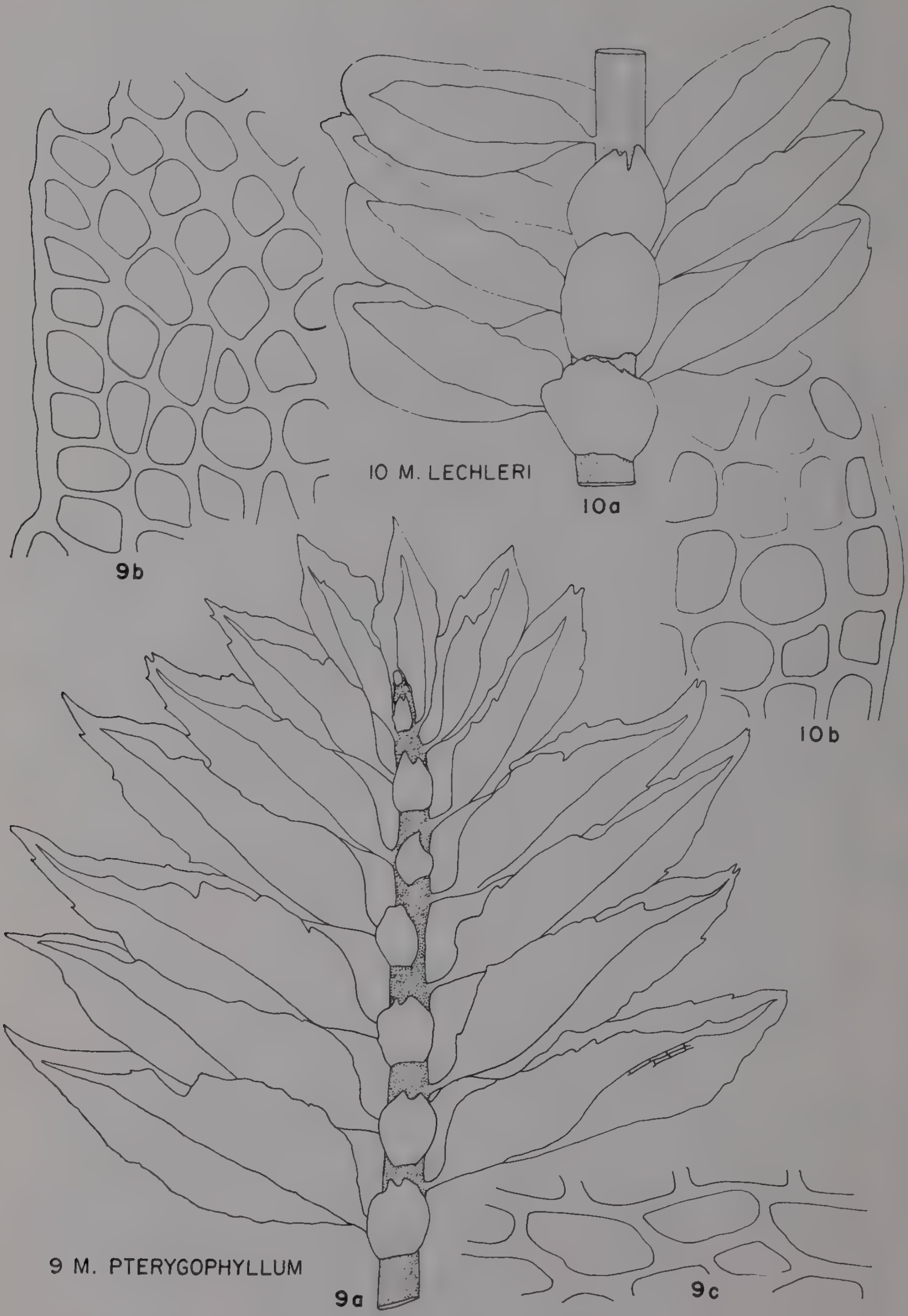
9b
10 M. LECHLERI
10a
10b
9 M. PTERYGOPHYLLUM
9a
9c

Plate 59

orbicular to longer than broad, the apex with one to four teeth. Plants dioicous, the short sexual branches ventral from near the base of the leafy stem or rarely from the rhizome. Male branches small, hyaline to brownish, the bracts in two to four pairs, long-ovate, inflated, acute to bifid, and with toothed margins, the bracteoles plane, ovate, 2- to 4-toothed above as in the underleaves. Female branches very short, the bracts in three series, more or less keeled, at first whitish, then becoming brown, the innermost bracts long-ovate, to 1.5 mm long, divided to one-fourth of their length into two or three long narrow, ciliate segments, the lateral margins short-ciliate. Perianth 4–5 mm long, the mouth contracted, long ciliate. Sporophyte not seen. Pl. 59. Fig. 10, a, b.

Habitat: Moist clay, sand, logs, and trees in mist forests.

COLOMBIA: Meta: Cordillera La Macarena, Pico Renjifo, Caño Tiranas, 1700 m, *Schultes & Cabrera 11227* (FH). Caquetá: Río el Hacha, *Woronow 181, 182a* (Hb Herzog).
PERU: Tatanera, *Lechler,* the type [not seen].

11. **Micropterygium bolivarense** Fulford, sp. nov.

Caules foliosi 0.5–1 cm longi, e viridibus fuscis ad brunneos, vix complanati; folia parva, concava, ex acutis ad breviter bifida, marginibus integris vel dente uno apicem versus instructis, ala absentia vel rare inchoata; foliorum cellulae 16–18 μ, mamillis magnis, trigonibus conspicuis, cuticulo crasse verruculoso; inflorescentiae masculae feminaeque non visae.

Leafy stems of small to medium size, dark green to brown, scarcely flattened, prostrate or ascendent from a branched rhizome system, scattered among other bryophytes; stems 0.5–1 cm long, with leaves 0.4–0.9 mm broad, sometimes becoming flagelliform, branches frequent, leafy, ventral or lateral. Rhizoids colorless, in tufts on reduced leaves of attenuate stem tips. Leaves symmetric, deeply concave, ovate, without or rarely with a keel-ridge, the apex acute or shortly bifid, often curved upward, the margins entire, serrate, or with an occasional tooth near the tip, a wing absent, or rarely rudimentary, of a few cells, on occasional leaves conspicuous, narrow; leaf cells 16–18 μ, with a very large mamillose projection over each cell, trigones conspicuous, the cuticle rough, warty. Underleaves near the base of the stem large, orbicular, concave, those toward the tip often becoming smaller, the cells as in the leaf. Male and female inflorescences and sporophyte not seen. Pl. 60. Fig. 11, a–e.

Habitat: On sandstone rocks, ledges, sandy soil along streams, and on trees in dense forests.

VENEZUELA: Estado Bolívar: Chimantá Massif, Torono-tepuí, 2168–2170 m, *Steyermark & Wurdack 695 p.p.* (NY); Río Paragua, salto de Aurima 275 m, *Killip 37352* (type, VEN), *37353 p.p.* (VEN); se Cerro Venamo, tributary of Río Venamo, 950–1000 m, *Steyermark & Dunsterville 92244 p.p., 92246 p.p., 92259 p.p., 92310 p.p.* (VEN); Auyan-tepuí tributary of Río Churún, 1760–1800 m, *Steyermark 93330, 93602 p.p., 93667* (NY); tributary of Río Churún, 2050–2300 m, *Steyermark 93951, 93953, 93998 p.p., 93999, 94022* (NY).

The distinguishing characters of the species are the concave leaves without wings, and the extremely large mamillae with rough-warty cuticle, on the cells of the leaves and underleaves.

Plate 59

Fig. 9. *Micropterygium pterygophyllum.* 9 a. Stem, ventral view, × 75. 9 b. Cells of the dorsal margin of a leaf near the apex, × 700. 9 c. Row of elongated cells at the line of attachment of the wing, × 700.

Fig. 10. *M. lechleri.* 10 a. Stem, ventral view, × 75. 10 b. Cells of the dorsal margin of a leaf near the apex, × 700.

Figure 9 drawn from the type.

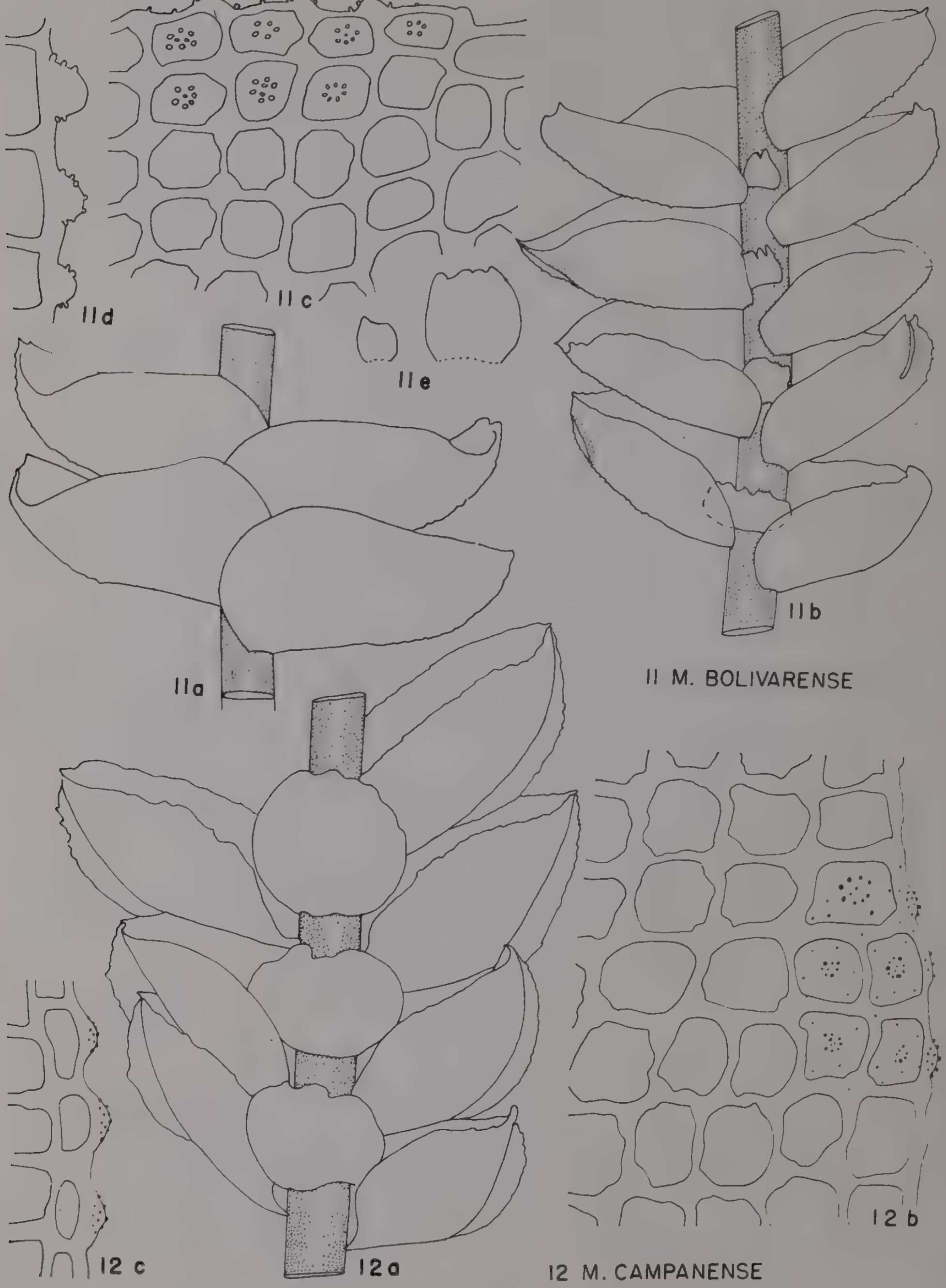
11 d
11 c
11 e
11 a
11 b
11 M. BOLIVARENSE
12 c
12 a
12 M. CAMPANENSE
12 b

Plate 60

FIG. 11. *Micropterygium bolivarense*. 11 a. Stem, dorsal view, × 75. 11 b. Stem, ventral view, × 75. 11 c. Cells of the dorsal margin of a leaf near the apex, × 700. 11 d. Superficial papillose mamillae of the leaf cells, profile view, × 700. 11 e. Underleaves, × 75.

FIG. 12. *M. campanense*. 12 a. Stem, ventral view, × 75. 12 b. Cells of the dorsal margin

The species is similar to *M. campanense* in size and habit, cell size and mamillose thickenings, but in *M. campanense* the wing while small, is well developed, the underleaves are larger, and the mamillae are not so large. *M. bolivarense* differs from *M. parvistipulum* in that in the latter the stems are larger, complanate, the leaves are flattened, with a sharp keel and a long broad wing, and the leaf margins are serrate and dentate throughout.

12. **Micropterygium campanense** (Spruce ms) Reimers, Hedwigia **73:** 157. *f. 6.* 1933.

Micropterygium campanense Spruce nom. nud. Trans. Proc. Bot. Soc. Edinb. **15:** 385. 1885.

Leafy stems of small to medium size, compact in tufts or mats, yellow-brown, scarcely flattened, prostrate from a branched rhizome system; stems 1–1.5 mm long, with leaves, to 0.7–1.0 mm broad, lateral branches occasional. Leaves spreading, ascendent in the outer part, broadly ovate, to 0.5 mm long, concave, ridge-keeled in the upper part, the wing of three to five rows of cells extending from the apex to the middle of the leaf or less, the margins crenulate and distantly serrate; cells of the apical portion more or less round-quadrate, 12–15 μ, the walls thin, trigones small but distinct, the outer surface convex and bearing a conspicuous mamilla, the cuticle smooth. Underleaves large, orbicular to obovate, broader than the stem, concave, the upper margin with two to four obscure lobes or teeth. Inflorescences and sporophyte not seen. Pl. 60. Fig. 12, a–c.

Habitat: Sandy banks along streams, bases of trees, rocks, logs, and stumps, in the rain forest.

VENEZUELA: Amazonas: Río Orinoco, Cerro Yapacana, Cumbre, 1200 m, *Maguire, Cowan, Wurdack 30695* ♂ (NY); Río Cunucunuma, 1200 m, *Maguire, Cowan, Wurdack 29911* ♂ (NY); Estado Bolívar: se Cerro Venamo, Río Venamo, 1000 m, *Steyermark & Dunsterville 92259 p.p.* (VEN); Auyan-tepuí, tributary of Río Churún, 1760 m, *Steyermark 93350 p.p.* (NY).

PERU: Mt. Campana, *Spruce, Hep. Spruc.* (isotype NY).

13. **Micropterygium trachyphyllum** Reimers, Hedwigia **73:** 186. *f. 15–19.* 1933.

Jungermannia pterygophyllum Nees var. *β conferta* Lehmann, Pug. Pl. **6:** 59. 1834.

Micropterygium vulgare Nees, Lindenberg & Gottsche, var. *β* in G. L. & N. Syn. Hep. 234. 1844. [excl. loc. cit.: "Mart. icon. . . ."]

Micropterygium vulgare Nees, Lindenberg & Gottsche, var. *β* in Lindenberg & Gottsche, Spec. Hep. VIII–XI: 114. Pl. 21, *f. 11–14.* 1851. [excl. loc. cit.: "Mart. icon. . . ."]

Micropterygium pterygophyllum (Nees) Trevisan p.p. Mem. Ist. Lomb. III. **4:** 413. 1877.

Micropterygium pterygophyllum Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 384. 1885. [excl. loc. cit.: *"J. pterygophyllum* Nees in Mart. Fl. Bras. icon., T. 19."]

Micropterygium pterygophyllum Spruce apud Stephani, Spec. Hep. **3:** 543. 1909. [excl. loc. cit.]

Micropterygium trachyphyllum var. *cubense* Reimers, Hedwigia **73:** 188. *f. 15, 1–3.* 1933.

Micropterygium trachyphyllum var. *jamaicense* Reimers, Hedwigia **73:** 190. *f. 16, 1–5.* 1933.

Micropterygium trachyphyllum var. *guadeloupense* Reimers, Hedwigia **73:** 190. *f. 17.* 1933.

Micropterygium trachyphyllum var. *guyanense* Reimers, Hedwigia **73:** 192. *f. 18.* 1933.

Micropterygium trachyphyllum var. *brasiliense* Reimers, Hedwigia **73:** 195. *f. 19.* 1933.

Leafy stems of medium to large size, dull, light to olive-green or brown, complanate, ascending from a branched rhizome, in extensive cushions or mats

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of a leaf, near the apex, × 700. 12 c. Superficial papillose mamillae of the leaf cells, profile view, × 700.

Figure 11 drawn from the type; fig. 12 from an isotype.

or among other bryophytes; stems 2–4 cm long, with leaves 0.8–1.5 mm wide, branches frequent, lateral branches leafy, ventral flagelliform branches occasional. Rhizoids in tufts from the scale-leaves of flagelliform branches and the rhizome. Leaves spreading to patent, imbricate, flattened, long-ovate, concave, acute, the wing to five cells wide, extending from the apex to beyond the middle or to the base, the margins crenulate, serrate, dentate and incised; leaf cells mostly quadrate, 14–18 μ, a conspicuous mamillose projection over the ventral surface of most cells, the walls thickened, trigones distinct, the cuticle finely to coarsely verruculose. Underleaves large, broader than the stem, orbicular to truncate-ovate, the upper margin undulate or 1- to 4-toothed. Plants dioicous, the male and female inflorescences usually on short sexual branches from near the base of the leafy stem. Male inflorescence basal, very rarely terminal on the stem, the bracts in two to five or more pairs, small, concave, inflated, the bracteoles ovate; antheridia two, in the axil of a bract. Female bracts and bracteoles in several series, the innermost series the longest, long laciniate-ciliate above. Perianth to 6 mm long, the mouth long ciliate-laciniate. Sporophyte not seen. Pl. 61. Fig. 13, a–g.

Habitat: On trees, logs, rocks and banks in wet forests.

CUBA: Oriente: *Sierra Maestra, Morton 9460a p.p., 9461 p.p.* (US); "La Bayamesa" 1725–1750 m, *Ekman 7185, 7186, 14628* (S-PA); Moa Region, *Webster 814* (MICH); Cobre Range, *León, Clement & Roca 10245* (NY, Y); Loma Joaquin 1600 m, *Ekman 5315 p.p.* (S-PA); Loma Mensura, 975 m, *Ekman 5754* (S-PA); without locality, *Yuncker 12598* (DPU); without locality, *Wright, Hep. Cub. Wrightianae,* = var. *cubense* Reim. (NY, US, Y).

JAMAICA: Caledonia Peak, *M. Farr 1008, 1010* (IJ); Cuna Cuna, *M. Farr 1343, 1344, 1377, 1389 p.p.* (IJ); sw Ecclesdown, *M. Farr 1151 p.p.* (IJ); Fairy Glade, *M. Farr 529 p.p.* (IJ); Hardwar Gap, *Baxter 23* (KAN); Hollymount, *E. G. Britton & Marble 400* (NY); Mt. Horeb, *Welch 17831, 17834 p.p.* (DPU); Mabess River, *Evans 316* = var. *jamaicense* Reim. (NY, US, Y); St. Thomas: Maccasucker Bump, 825–1025 m, *Maxon 9601* (NY, US); without locality, *Wilson, Underwood, N. A. Hep.* (NY), *Wilson 821* (NY), Wilds (NY), Brown (NY).

GUADELOUPE: Baines Jaunes, *Duss 1024* (NY); Galion, *Le Gallo 263 p.p., 264* (Hb *Le Gallo*); Le Lamentin, *Duss 40* (NY); *Macouba, Duss 1037* (NY); Soufrière, *Duss 445* (NY); without locality, *l'Herminer,* = var. *guadeloupense* Reim. (NY, Y).

DOMINICA: Morne Diablotin, *Elliott 2120* (BM); Morne Trois Pitons, *Elliott 2301* (BM).

MARTINIQUE: Morne Paillasse, *Duss 401* (NY).

BARBADOS: without locality or collector no. *171,* as *J. pterygophyllum,* var. *β conferta* (type NY; Hb Nees STR) = var. *guianense* Reim.

TRINIDAD: Blanchesseuse Rd., *Broadway 7875* (as var. *guyanense* (BM); s.n., *Broadway* (NY, Y).

COLOMBIA: Amazonas—Vaupés: Río Apaporis, Soratama, 250 m, *Schultes & Cabrera 13201, 13207, 15132* (FH); Río Piraparaná, *Schultes & Cabrera 15899 p.p.* (FH); Vaupés: Río Tui [y], *Schultes & Cabrera 14427* (FH).

VENEZUELA: Estado Bolívar: Chimantá Massif, Río Tirica, 485–490 m, *Steyermark & Wurdack 171* (NY); se Cerro Venamo, Río Venamo, 950–1000 m, *Steyermark & Dunsterville 92217 p.p., 92218 p.p., 92231 p.p., 92232 p.p., 92235 p.p., 92244 p.p., 92258 p.p., 92276 p.p.* (VEN); the same, 950–1400 m, *Steyermark & Dunsterville, 92310 p.p., 92313 p.p.* (VEN); Auyan-tepuí, *Steyermark 93399* (NY); above Guayaracá, 1000–1480 m, *Steyermark 94136, 94161A* (NY); Sierra Ichún, 500 m, *Steyermark 90318A p.p., 90343 p.p., 90388 p.p., 90388A, 90446 p.p.* (VEN).

GUIANA: without locality, Hb Montagne, as *M. vulgare,* (NY); *Leprieur,* Hb. Montagne (PC).

BRITISH GUIANA: Kaieteur Falls, Río Potaro, *Tutin 510* (BM); *Noel 82a* (Y); Río Essequebo, *A. C. Smith 2706* (NY, US); nr Bartica, *P. Richards 772* (Y); s.l., ex Hb Montagne, as *M. cymbifolium* (BR); s.l., *Leprieur 1388,* Hb Montagne (PC).

FRENCH GUIANA: s.l., Hb Thériot (NY); Cayenne, ex Hb Montagne, as *Herpetium pterygophyllum β* (STR), s.l., Hb Montagne (PC).

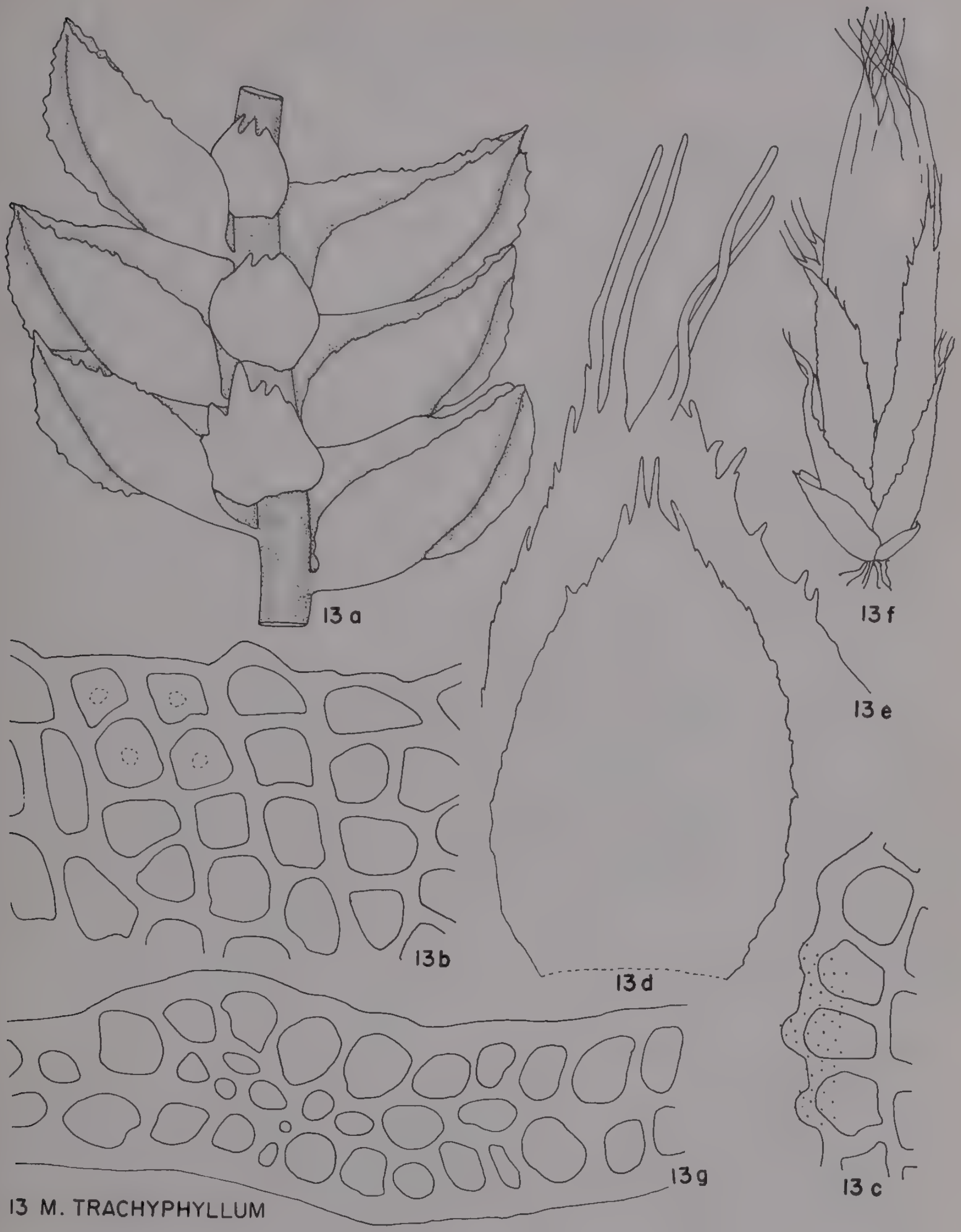

Plate 61

Fig. 13. *Micropterygium trachyphyllum.* 13 a. Stem, ventral view, × 75. 13 b. Cells of the dorsal margin of a leaf near the apex, × 700. 13 c. Superficial mamillae of the leaf cells, profile view, the cuticle verruculose, × 700. 13 d. Female bract of an intermediate series, × 75. 13 e. Portion of a female bract of the innermost series, × 75. 13 f. Female inflorescence and perianth (immature), × 75. 13 g. Transverse section of the 2-, 3-layered basal portion of the perianth, × 700.

SURINAME: s.l., *Funck* in Hb Nees, as *H. pterygophyllum* f. *intermedia* (STR), s.l., Hb Montagne (PC).

BRAZIL: Rio Negro, *Spruce, Hep. Spruc.* as *M. pterygophyllum* (Y); Rio Uaupés, Juticá, Campos, *Lützelberg 23636, 23636a* = var. *brasiliense* Reim., *23715* (Hb Herzog); s.l., *Bolmer 91* (Hb Herzog).

14. **Micropterygium parvistipulum** Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 383. 1885.

Leafy stems of small to medium size, greenish to yellow-brown, compact, flattened, ascending from a branched rhizome, in mats; stems 0.5–1 cm long, with leaves to 1 mm broad, occasionally irregularly pinnately branched, and with numerous ventral flagelliform branches. Rhizoids in tufts from the scale-leaves of the flagelliform branches. Leaves patent, closely imbricate, usually lanceolate in outline when folded, to 0.64 mm long, ridge-keeled for most of the length, the dorsal and ventral parts more or less equal, the wing conspicuous, of three to five rows of cells, extending down to below the middle, the apex acute or shortly bifid, the margins crenulate and serrate; cells of the apical portion 14–18 μ, the wall over each cell strongly convex to mamillose, the walls thickened, trigones distinct, the cuticle verruculose. Underleaves conspicuous at the base of the stem, decreasing in size and becoming obscure toward the apex, the margin irregularly toothed and lobed. Male and female inflorescences and sporophyte not seen. Pl. 62. Fig. 14, a–d.

Habitat: On ledges, banks, and wet rocks in forests.

COLOMBIA: Vaupés: Río Vaupés, near Mitú, Raudal Cuacurabá, *Schultes & Cabrera 19272* (FH); Río Kananari, Cachivera Palito, 250 m, *Schultes & Cabrera 13112* (FH).

VENEZUELA: Estado Amazonas: Serrania Parú, Río Ventuari, Cumbre, 2000 m, *Cowan & Wurdack 31327* (NY); Estado Bolívar: Chimantá Massif, Torono-tepuí, 2165 m, *Steyermark & Wurdack 688 p.p.* (NY).

BRAZIL: Rio Içana, Tunuí, *Lützelburg 22947* (Hb Herzog); Rio Negro, *Spruce, Hep. Spruc.* ♀ (isotypes, BR, NY, US, Y); Rio Negro, *Spruce* (NY); Rio Negro, S. Gabriel, *Spruce, Hep. Spruc.* (var. *lancifolium*) (BR, NY, US, Y); Rio Negro, S. Felippe, *Lützelburg 22393a* (Hb Herzog); Rio Vaupés, Jutica, Varadouro, *Lützelburg 23636b* (Hb Herzog); s.l., *Glaziou 14418♂* (NY).

Certain packets of this collection contain plants with leaves in which the cell walls are plane or only convex and not mamillose. These have been cited under *M. pterygophyllum*.

15. **Micropterygium bialatum** Fulford, sp. nov.

Caules foliosi ad 2 cm longi, viridi-brunnei, complanati; folia brevia, late ovata, concava, carina alarum pari una instructa; foliorum cellulae 12–16 μ, mamillosae, cuticulo verruculoso; amphigastria saepe magna basim caulis versus, supra parviora vel paullis cellulis compositae. Partes aliae non visae.

Plate 62

FIG. 14. *Micropterygium parvistipulum*. 14 a. Stem, ventral view, × 175. 14 b. Portion of a leaf, × 150; M, large mamillae. 14 c. Cells of the dorsal lamina near the apex, × 700. 14 d. Superficial verruculose mamillae of the leaf cells, profile view, × 700.

FIG. 15. *M. bialatum*. 15 a. Stem, dorsal view, × 75. 15 b. Stem, ventral view, × 75. 15 c. Cells from the dorsal lamina near the apex, × 700. 15 d. Verruculose mamillae of the dorsal surface of the leaf cells, profile view, × 700. 15 e. Double wing, near the leaf apex, × 300. 15 f. Transverse section showing the double wing, × 300. 15 g. Portion of a transverse section of a stem, × 300.

Figure 14 drawn from an isotype, fig. 15 from the type.

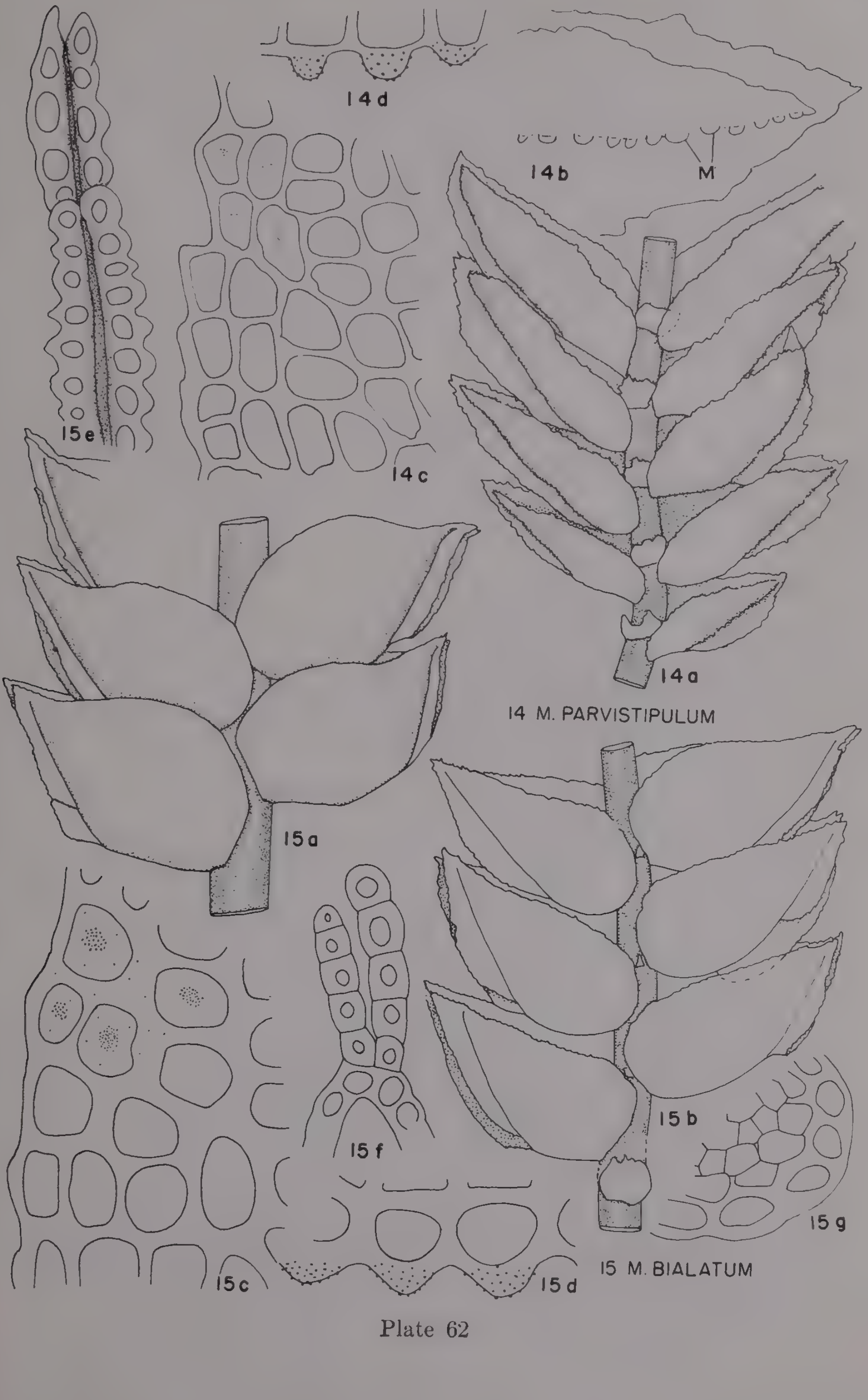
M
14 M. PARVISTIPULUM
15 M. BIALATUM

Plate 62

Leafy stems of small to medium size, complanate, ascending to erect from a branched rhizome, forming dense greenish- to yellow-brown cushions or scattered among other bryophytes; stems to 2 cm or more long, with leaves to 1.0 mm broad, branches frequent, both lateral and ventral, leafy. Rhizoids in tufts from the scale-leaves of the rhizome. Leaves imbricate, short, broadly ovate, acute or bifid by one or two cells, strongly concave, a ridge-keel and a *pair* of wings, three to five cells wide developed in the upper half, the margins crenulate-serrate or rarely dentate; leaf cells quadrate in outline, 12–16 μ, mamillose projection developed on the ventral surface of most cells, the walls uniformly thickened, the cuticle verruculose. Underleaves often large near the base of the stem, orbicular-concave, soon becoming very small or reduced to a few cells throughout most of the stem. Male and female inflorescences and sporophyte not seen. Pl. 62. Fig. 15, a–g.

Habitat: On moist soil banks, moist sandstone bluffs and bases of trees, forests.

VENEZUELA: Estado Amazonas: Serrania Parú, Río Venturi, Cumbre, 2000 m, *Cowan & Wurdack 31327* (type, NY). Estado Bolívar: Chimantá Massif, Torono-tepuí, 2165–2180 m, *Steyermark & Wurdack 695 p.p.* (NY); se Cerro Venamo: escarpment, 1500 m, *Steyermark & Dunsterville 92586 p.p., 92595 p.p.* (VEN); base of bluff, tributary of Río Venamo, 1220–1275 m, *Steyermark & Dunsterville 92758* (VEN); Auyan-tepuí: nr Río Churún, 1660 m, *Steyermark 93823* (NY); n of El Liberator, 2050–2300 m, *Steyermark 93946 p.p., 93947, 93948, 93950 p.p., 93951, 93952, 93955* (NY).

16. **Micropterygium steyermarkii** Fulford, sp. nov.

Caules foliosi ut videtur radiales, ad 10 mm longi, e viridibus ad luteobrunneos; folia lanceolata, acute carinata, ad basim alata, apice obtuso, marginibus crenulato-mamillosis, superficie crasse verruculosa; amphigastria similia sed carinis alisque carentia. Inflorescentiae femineae breves, basilares, bracteis bracteolisque ex ovatis ad ovato-lanceolatas. Inflorescentia masculina et sporophytum absentia.

Leafy stems of small to medium size, appearing radial, green becoming yellow-green, ascendent to erect from a branched rhizome, in tufts; stems to 10 mm long, with leaves, to 1 mm broad, the leaves and underleaves lanceolate, stiff, widely spreading; leafy branches frequent, flagelliform branches occasional, from the axils of the underleaves. Leaves widely spreading to patent, distant, symmetric, long-lanceolate, 0.5–0.8 mm long, the tip blunt, sharp-keeled to the base, the wing extending the whole length, three or four rows of cells wide, the inner row elongate as in the keel, surface of the leaf and the keel coarsely mamillose, the margins coarsely mamillose-crenulate from projecting cell thickenings; cells of the lamina and outer part of the wing round-quadrate, 10–13 μ, the walls uniformly thickened, the trigones indistinct, cells along the keel two or three times as long, each cell with a very large mamillose protuberance on the outer surface, the cuticle, especially over the mamillae, coarsely verruculose. Underleaves similar but without a keel and wing, the margins crenulate-mamillose, the surface coarsely mamillose, the cells as in the leaf, i.e., of the median portion elongate, of the lamina round-quadrate. Plants dioicous. Female branches very short, from near the base of the leafy axis; the bracts and bracteoles in three or four series, ovate to ovate-lanceolate, the innermost series the largest, ending in several laciniae. Perianth, sporophytes and male inflorescence not seen. Pl. 63. Fig. 16, a–h.

Habitat: Base of a fern tree.

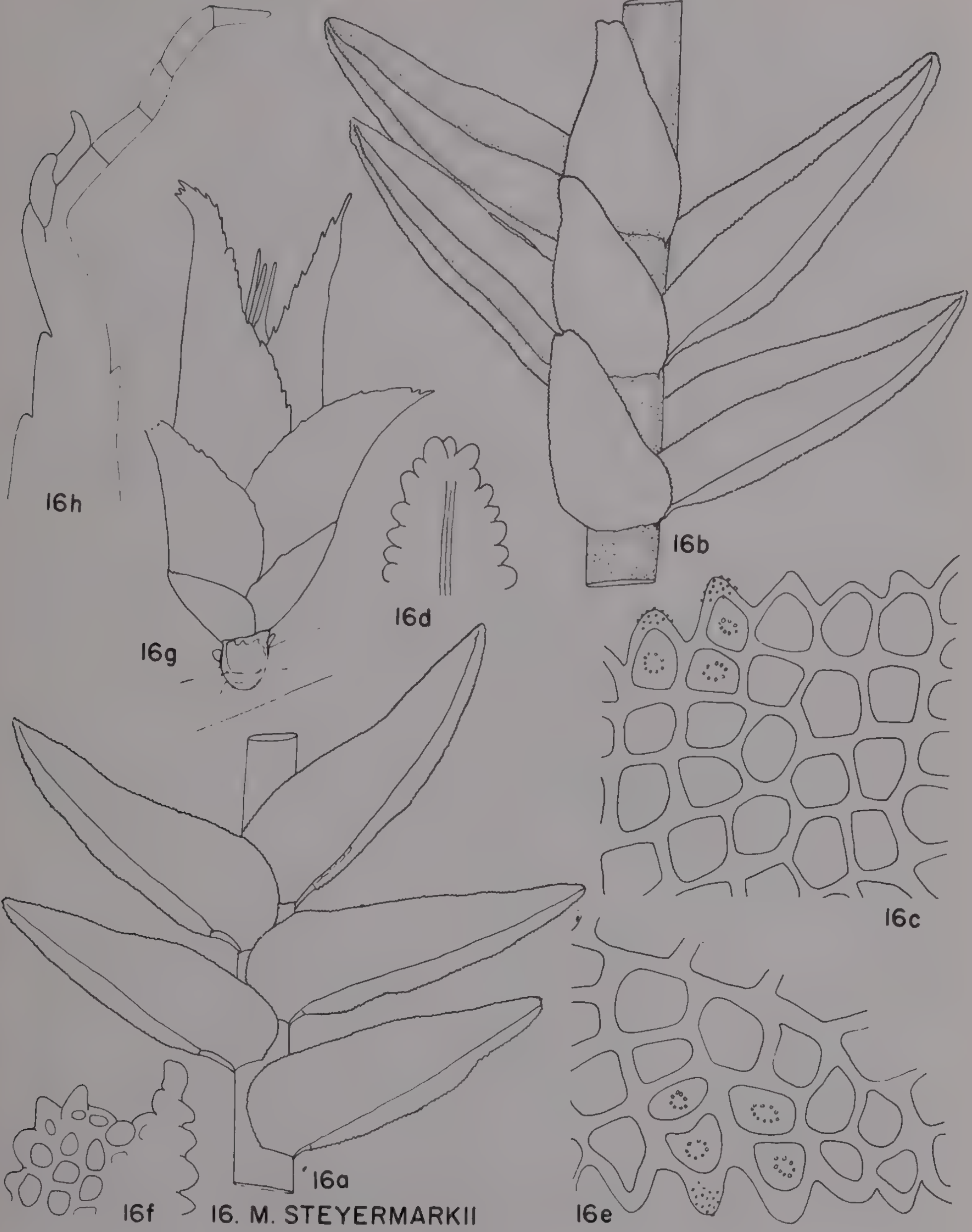
16h
16b
16d
16g
16c
16a
16e
16f
16. M. STEYERMARKII

Plate 63

FIG. 16. *M. steyermarkii.* 16 a. Stem, dorsal view, × 75. 16 b. Stem, ventral view, × 75. 16 c. Cells of the leaf margin, × 700. 16 d. Outline of the apex of a leaf, × 300. 16 e. Cells of a portion of a wing, × 700. 16 f. Apex of an underleaf, × 300. 16 g. Female inflorescence, × 75. 16 h. One of the laciniae of a bract of the innermost series, × 300. Drawn from the type.

VENEZUELA: Estado Bolívar: Auyan-tepuí, canyon, 2150–2200 m, *Steyermark 94049* (type, NY).

Because of its nearly radial form the species suggests *M. grandistipulum* but is at once distinguished from the latter because of the stiff habit, the leaves with a long wing on a sharp keel, and the very large mamillae of the cells.

17. Micropterygium conchifolium Reimers, Hedwigia **73:** 155. *f. 5.* 1933.

Leafy stems of small to medium size, compact, in mats or scattered among other bryophytes, yellow-brown to dark green, ascending from a branched rhizome system; stems to 1.5 mm long, with leaves, 0.8–1.2 mm broad, lateral branches occasional. Leaves spreading, ascendent in the outer part, broadly ovate, more or less concave, 0.8–1.0 mm long, keeled in the upper part, the wing of two to four rows of cells extending from near the apex to the middle of the leaf or less, the margin undivided, crenulate from projecting cell walls; cells of the apical portion round-quadrate, 10–13 μ, the walls thin, the trigones distinct; the surface plane, the cuticle smooth. Underleaves large, orbicular to obovate-rounded, broader than the stem, the upper margin entire or rarely obscurely toothed, the cells and margin as in the leaf. Inflorescences and sporophyte not seen. Pl. 64. Fig. 17, a–d.

Habitat: Shaded sandy banks along streams and on wet sandstone cliffs.

VENEZUELA: Estado Bolívar: Auyan-tepuí, tributary of Rió Churún, 1760 m, *Steyermark 93355* (lectotype VEN); Río Churún, 1660 m, *Steyermark 93792 p.p., 93819* (VEN). Mt. Duida, 2000 m, *Tate 514* ("Type, NY; cotype B"—but apparently lost).

18. Micropterygium tumidulum Fulford, sp. nov.

Caules foliosi parvi, graciles, compacti, 0.5–1 cm longi; folia symmetrica, concava, inflata, patenti-ascendentia, apice sursum curvato, marginibus integris, ala parva nonnunquam praesenti in parte superiore; cellulae 15×15 μ, parietibus incrassatis, trigonibus magnis lateribus convexis, luminibus angulari-rotundis, cuticulo aspero-verruculoso verrucis magnis rotundis.

Leafy stems small, compact, slender, greenish to yellow-brown, prostrate to ascendent from a branched rhizome system; stems 0.5–1 cm long, with leaves to 0.5 mm broad, often abundantly branched, the branches at first radial with small, orbicular leaves and underleaves, becoming larger, dorsiventral with obscure underleaves in the upper two-thirds, or occasionally flagelliform. Rhizoids on the scale-leaves of the rhizome and the flagelliform branches. Leaves densely imbricate, symmetric, concave, strongly inflated, spreading, becoming ascendent in the outer part, the apex curved upward, often bifid by a pair of cells, a short, narrow wing sometimes present, the margins entire; cells quadrate in outline, mostly 15×15 μ, the walls thickened, trigones large with bulging sides, the lumina angular-rounded, the cell surface covered with rounded to elongate warts as in the genus *Mytilopsis*. Underleaves of the base of the shoot rounded, as broad as the stem, becoming progressively smaller upward, reduced to only a few cells near the stem tip. Female branches frequent, short, several on the lower part of a stem or the rhizome, the bracts and bracteoles ovate to ovate-lanceolate, the lateral margins of the inner series serrate and dentate, the apical part of several long laciniae. Male branches, perianth and sporophytes not seen. Pl. 64. Fig. 18, a–d.

Habitat: Moist base of sandstone escarpment.

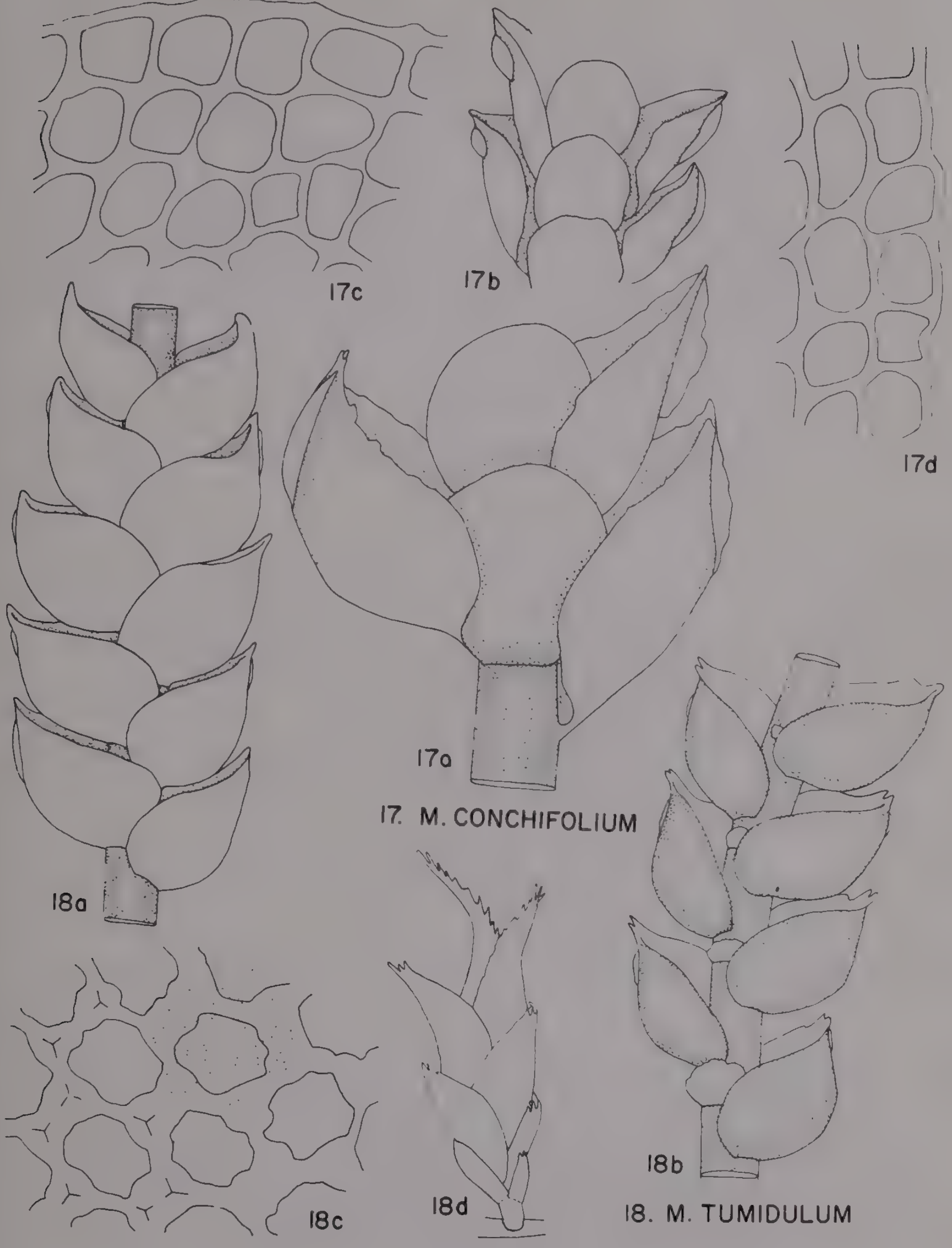
17c
17b
17d
17a
17. M. CONCHIFOLIUM
18a
18b
18. M. TUMIDULUM
18c
18d

Plate 64

Fig. 17. *M. conchifolium.* 17 a. Stem, ventral view, × 75. 17 b. Stem, ventral view, × 35. 17 c. Cells of the dorsal margin of a leaf, × 300. 17 d. Cells of the wing, × 300. Drawn from the lectotype.

Fig. 18. *M. tumidulum.* 18 a. Stem, dorsal view, × 75. 18 b. Stem, ventral view showing underleaves, × 75. 18 c. Leaf cells, × 700. 18 d. Female inflorescence, × 75. Drawn from the type.

VENEZUELA: Estado Bolívar: Auyan-tepuí, along Río Churún, 1660 m, *Steyermark 93792* (type NY).

This species shows a combination of the characters of several other members of the genus. The tendency toward a decrease in size of the underleaves from the base to the tip of the leafy stem is characteristic of several species. The size and general habit of the plant suggests *M. exalatum* of Puerto Rico and Dominica but differs particularly in the very large warts of the cuticle. In *M. exalatum* the cuticle has very small, scarcely noticable verruculae.

The cells and warty cuticle are like those of plants of the monotypic *Mytilopsis albifrons*. Furthermore, in the latter, on the smaller-leaved lower part of a leafy branch (a reversion), the leaves are inflated, and large, orbicular underleaves are present. In the adult stems of *Mytilopsis* in contrast, the leaves are flat, complicate, equitant, and deeply bifid. Underleaves are absent.

Taxa Not Available for Study

Micropterygium angustistipulum Spruce, Mt. Campana, Peru.

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The characters of this monotypic genus are those of the species as given below. Type species: *Mytilopsis albifrons* Spruce.

1. **Mytilopsis albifrons** Spruce, Trans. Proc. Bot. Soc. Edinb. **15:** 387. *pl. 14.* 1885.

Leafy stems complanate, ascendent from a prostrate, branched rhizome system, yellow to dark brown, in mats or among other bryophytes; stems 1–2 cm long, with leaves, to 0.7 mm broad, simple or branched, the branches ventral, leafy or flagelliform; in transverse section the stem with a cortical layer of usually 12 rows of large cells with very thick yellow-brown walls surrounding a medulla of large, colorless thin-walled cells. Rhizome branches rhizome-like, or flagelliform, with scale-leaves, or radial with small orbicular leaves and underleaves, or complanate leafy without underleaves. Rhizoids in tufts on the scale-leaves of rhizomes and flagelliform branches. Line of leaf insertion short, transverse, the leaf-base of 12 elongate cells. Leaves equitant-imbricate, widely spreading, bilobed, equally folded, flat, the keel sharp, a wing not developed (at most of only one row of cells), the basal auricles extending across the stem and beyond on both the dorsal and ventral sides, the apex subtruncate with an ascendent tip, the margins dentate, in the upper part often erose; leaf cells quadrate in outline, the trigones large with bulging sides, the outer surface strongly convex, very thick-walled, the cuticle papillose-warty. Underleaves absent on the leafy stem. Plants dioicous, the sexual branches short, ventral, from near the base of the leafy stem. Male inflorescence short to long, hyaline, catkin-like, the bracts and bracteoles in several series, the bracts concave, the bracteoles small ovate; antheridea borne singly. Female inflorescence with two or three series of similar bracts and bracteoles, the inner series longest, long-ovate, concave, the cells rectangular, the apex bifid, the margins lacerate. Perianth to 4 mm long, trigonous to cylindrical below, of two or three layers of cells, contracted above with eight or nine folds or rounded keeled, the mouth fringed with simple cilia three to six long cells. [Capsule oblong cylindrical, the wall two-layered, the elaters bispiral, spores finely tuberculate; after Spruce.] Pl. 65. Fig. 1, a–h.

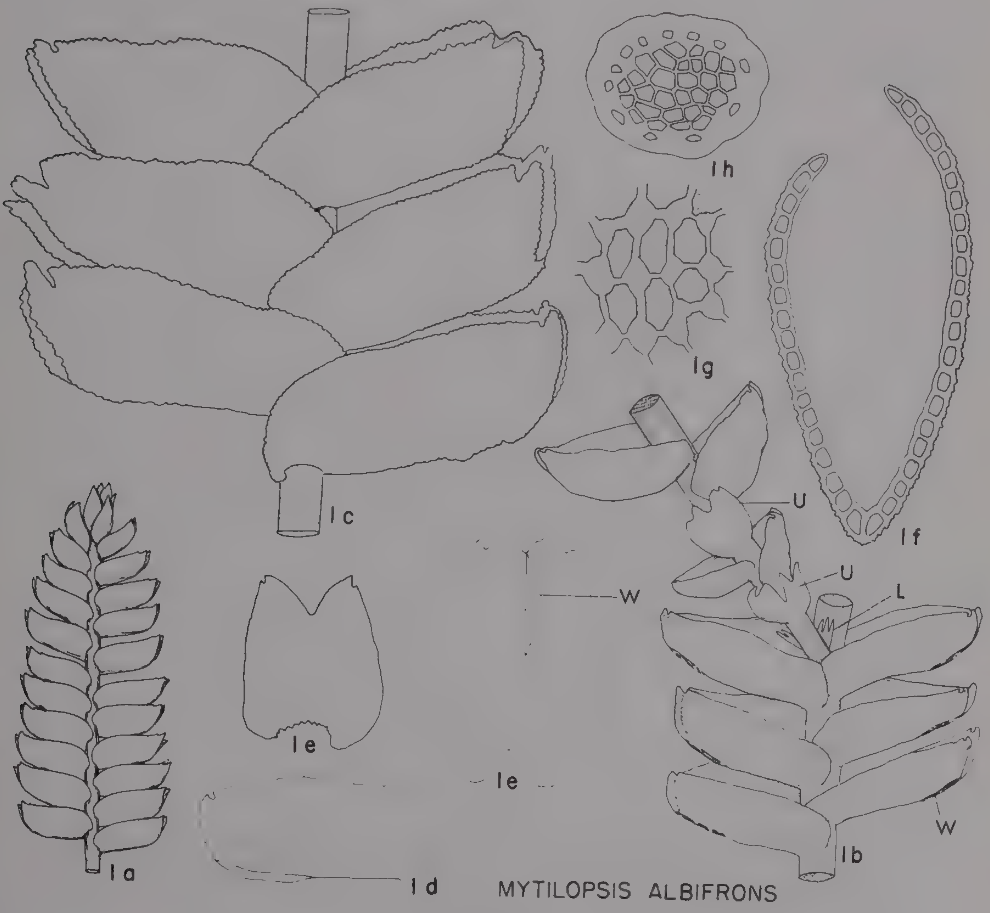

Plate 65

FIG. 1. *Mytilopsis albifrons.* 1 a. Leafy stem, dorsal view, × 75. 1 b. Leafy stem with a ventral-intercalary leafy branch, ventral view, × 40; L, *juvenile* [?] leaf; U, underleaves on the basal part of the branch, W, wing. 1 c. Stem, dorsal view, × 75. 1 d. A leaf (complicate), × 57. 1 e. Leaves, opened out, × 50; W, wing. 1 f. Transverse section through a leaf below the winged keel, × 180. 1 g. Leaf cells, × 350. 1 h. Transverse section of a stem, × 140. Drawn from the isotype.

Habitat: On trunks and branches of trees, moist rocks, and the base of sandstone escarpments, in forests at higher elevations.

JAMAICA: Fairy Glade, Mt. Horeb, 4500 ft, *M. Farr 775* (IJ).

VENEZUELA: Estado Amazonas: Río Cunucunuma, Cerro Duida near Caño Culebra, 1700–1800 m, *Maguire, Cowan & Wurdack 29715* (NY); Caño de Dios, Cumbre, 1900 m, *Maguire, Cowan & Wurdack, 30276* (NY), sw escarpment, 1850 m. *Maguire, Cowan & Wurdack 30301* (NY). Estado Bolívar: Ptari-tepuí, 2410 m, *Steyermark 59890* (F); Chimantá Massif, central section nr "Summit Camp," 1925 m. *Steyermark & Wurdack 318* (NY); Torono-tepuí, summit, 2165–2180 m, *Steyermark & Wurdack 687* (NY); Abácapa-tepuí, 1300 m. *Steyermark 75216 p.p.* (NY), at 1800–2000 m, *Steyermark 74981 p.p.* (NY); se Cerro Venamo, Rio Venamo, 1000 m, *Steyermark & Dunsterville 92243 p.p.* (VEN); nr escarpment, 1400–1575 m, *Steyermark & Dunsterville 92542 p.p., 92547;* Auyan-tepuí: e of Salto Churún, 1850 m, *Steyermark 93426, 93428* (NY); Sierra Ichún, 625–725 m, *Steyermark 90294* (VEN).

PERU: Eastern Andes, 1000 m, *Spruce, Hep. Spruc.* (isotypes G, NY).

This genus is obviously closely related to *Micropterygium*, but is distinguished from it because of the distinctive form of the leaves, the regular pattern of the quadrate cells with rough-warty cuticle, the absence of underleaves, and the absence of lateral branches.

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MARGARET H. FULFORD

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(continued on inside back cover)

Memoirs of The New York Botanical Garden Vol. 11(3)

MANUAL
# of the
LEAFY HEPATICAE OF LATIN AMERICA[1,2]

PART III

by

Margaret H. Fulford[3]

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Key to the Genera (Part III)

1. Vegetative plant without leaves; consisting of a thallus or of flagelliform stolons, or of branched filaments; male and female inflorescence foliaceous, the bracts with a lamina.
   2. Plants branched, filamentous.
      3. Axis few-celled, branched; 1- or 2-celled leaves evident. *Regredicaulis monodactylus. p.* 359 (forms of) *Arachniopsis. p.* 361
      3. Axis absent; filaments uniseriate, irregularly branched, alga-like. *Protocephalozia. p.* 333
   2. Plants thalloid or of branched, flagelliform leafless stolons.
      3. Thallus with a well defined mid-rib and unistratose wings; wing margins with scattered, very long "slime" papillae parallel to the margin. *Pteropsiella. p.* 372
      3. Stolon-like branched flagelliform axes tiny, leafless; rhizoids scattered, not in tufts. *Phycolepidozia. p.* 383
1. Vegetative plant leafy.
   2. Leaves without a lamina, consisting of 1 or a pair of short or long uniseriate segments; underleaves of 2 adjacent cells, often bearing rhizoids.
      3. Segments 1 or 2 cells long; cells more or less spherical or short ovoid. *Regredicaulis monodactylus. p.* 359
      3. Segments 4 or more cells long; cells long rectangular in outline with the tip cell short. *Arachniopsis. p.* 361
   2. Leaves with a lamina of few to many cells.
      3. Leaves incubous, the insertion oblique to sublongitudinal; leaf apices rounded, mucronate, retuse or shortly bifid. *Calypogeia. p.* 279
      3. Leaves succubous with the insertion oblique to sublongitudinal, or the leaves subtransverse or transverse.
         4. Leaves with 2 (rarely 1) very long, sausage-shaped "slime" papillae, at the tips of the segments or on the rounded margins. *Zoopsis. p.* 368
         4. Leaves with small, soon disappearing, slime papillae.
            5. Leaves undivided or rarely retuse; underleaves absent or small, scale-like, becoming larger just below a female inflorescence.
               6. Leaves small, less than 12 cells in width at the middle.
                  7. Leaves to twice as long as wide; plants whitish, often becoming red near the tips. *Alobiellopsis. p.* 349
                  7. Leaves subquadrate, turgid, yellow-brown; cells with conspicuous brown bands of thickening. *Trabacellula. p.* 352
               6. Leaves larger, 15 to 20 or more cells in width at the middle.
                  7. Leaves elongate, subrectangular, the margins crisped or undulate; cells large, with large, translucent, knot-like trigones; branches dorsilateral and ventral, intercalary; underleaves ovate, with many marginal and superficial slime papillae. *Anomoclada. p.* 346
                  7. Leaves long-oval, subrectangular, or ovate-truncate, never crisped; cells large or small, trigones large to tiny; scale-like underleaves with only occasional slime papillae. *Odontoschisma. p.* 334
            5. Leaves bifid or at least bidentate (in *Alobiella* often only slightly so and the leaves appearing acute).
               6. Leaves divided to the middle into 2 similar, broad, rounded segments. *Cladopodiella. p.* 347
               6. Leaf segments acute or if rounded, the segments conspicuously unequal.
                  7. Underleaves conspicuous, well developed, bifid (an occasional one trifid).
                     8. Underleaves and leaves similar in size and form; cortical layer of the stem of 6 $(2 + 2 + 2)$ similar, very large, inflated cells. *Hyalolepidozia. p.* 377
                     8. Underleaves slightly smaller, or to only half as long as the leaves.
                        9. Leaves long-ovate, bidentate (often appearing acute), the seg-

ments short; leafy stems complanate; dorsal cortical cells of the stem between the 2 rows of leaves very large, inflated; rhizoids from the ventral side of the stem or from the surface of the caudex. *Alobiella. p.* 378

9. Leaves bifid (occasionally trifid) to one-half their length, underleaves bifid (some trifid) to the middle.

10. Underleaves with a conspicuous lateral tooth midway on both sides; branches only ventral-intercalary, leafy or flagelliform; leafy stems appearing flattened. *Cladomastigum. p.* 382

10. Underleaves without lateral teeth; branches both lateral and ventral; rhizoids in tufts, from the underleaves or in 3 rows on the flagelliform branches or caudex.

11. Ventral branches of the leafy stem always axillary-intercalary, leafy or flagelliform; leafy stems often appearing flattened, often from a prostrate caudex; ♀ inflorescence on a very short branch from the caudex. *Leucosarmentum. p.* 386

11. Ventral branches of the leafy stem both of the *Acromastigum* type, with a half-underleaf adjacent to the branch, and axillary-intercalary, leafy or flagelliform. *Paracromastigum. p.* 389

7. Underleaves reduced to 1 (rarely 2) rows of 2 to 4 adjacent cells across the stem, with or without 1 or 2 rudimentary segments; or few-celled, scale-like; or as 1 or 2 slime papillae, soon disappearing.

8. Underleaves of 1 (rarely 2) row of 2 to 4 adjacent cells with or without 1 or 2 rudimentary segments; rhizoids from the bases of the underleaves.

9. Underleaves usually with 1 or 2 rudimentary segments; leaves bi-, tri- or quadrifid to the middle; leaf segments uniseriate, soon broken. *Odontoseries. p.* 364

9. Underleaves without segments; leaves bifid.

10. Leaves obliquely inserted, *Cephalozia*-like, slime papillae when present small. *Regredicaulis. p.* 358

10. Leaves sublongitudinally inserted, the two "slime" papillae very long, sausage-shaped, persistent. *Zoopsis. p.* 368

8. Underleaves few-celled, scale-like, or absent; rhizoids from the ventral surface of the stem.

9. Plants some shade of brown, tinged with brown, or becoming reddish.

10. Plants coarse or delicate, often stiff, brownish-green to yellow-brown or straw-colored.

11. Leaves subquadrate, retuse, coarse; cells with many bands of thickening over the surface; cuticle coarsely roughened. *Trabacellula. p.* 352

11. Leaves bifid.

12. Leaf segments short, triangular, acute. *Fuscocephaloziopsis. p.* 353

12. Leaf segments slender, long-acuminate; ventral side of leaf forming an inflated sac. *Nowellia. p.* 326

10. Plants slender, often flaccid, reddish-brown to reddish.

11. Leaf segments slender, long-acuminate; ventral side of the leaf forming an inflated sac. *Nowellia. p.* 326

11. Leaf segments acute, or acuminate by only 2 cells; leaves concave, cup-shaped or variously twisted, never with a ventral sac. *Cephalozia. p.* 311

9. Plants green, whitish, or light yellow-green, only rarely tinged with red or brown at the tip.

10. Leaves with the ventral side forming a conspicuous inflated sac. *Nowellia. p.* 326

10. Leaves plane or variously concave or twisted but never with a ventral sac. *Cephalozia. p.* 311

CALYPOGEIACEAE H. Arnell, Skand. Fl. **2A**: 189. 1928.

Trigonantheae subfam. *Calypogeieae* K. Müller in Rabenhorst, Krypt.-Fl. **6**^{2}: 226. 1913.

Sporeling of the *Nardia* type, i.e., the protonema an irregular mass of cells developed outside the exospore; in *Calypogeia* the stem with primary leaves radially symmetric, the stem with juvenile or the adult type leaves dorsiventral. Branches ventral-intercalary, axillary, leafy or rarely flagelliform, or short sexual. Stem in transverse section of many similar cells, the cortical layer often slightly larger or smaller than the cells of the medulla. Rhizoids from small cells of the lower part of the underleaf. Line of leaf insertion oblique, the leaves incubous. Leaves undivided, acute or bifid. Underleaves ovate to orbicular, rounded, acute, bifid with or without a lateral tooth, or bisbifid. Male inflorescence ventral, catkin-like. Female inflorescence ventral, short, the bracts and bracteoles scale-like, the archegonia at the bottom of a long, pendant perigynium of the *Calypogeia* type. Perianth absent. Capsule wall 2-layered, at maturity divided into 4 erect, spirally twisted valves.

Type genus: *Calypogeia* Raddi corr. Corda, Opiz, Beitr. Naturg. 653. 1829.

Calypogeia Raddi corr. Corda, Opiz, Beitr. Naturg. 653. 1829.

Cincinnulus Dumortier, Comm. Bot. 113. 1822.
Kantia S.F. Gray corr. Carrington, Trans. Proc. Bot. Soc. Edinb. **10**: 308. 1870.

Plants prostrate, green to whitish, in mats or scattered among other bryophytes; stems irregularly branched, the branches ventral-intercalary, axillary, leafy, or rarely flagelliform, or short, male or female; stem in transverse section of many more or less similar cells, the single cortical layer often in part slightly larger or smaller or with thicker walls than the medulla. Rhizoids long, in tufts from small cells of the lower part of some underleaves. Line of leaf insertion oblique, often nearly longitudinal, the leaves incubous. Leaves symmetric or asymmetric, widely spreading to ascendant or falcate, often long decurrent, often bordered, the apex broad-rounded, acute, apiculate or shortly bifid; leaf cells subquadrate, rectangular or hexangular, the walls uniformly thickened or with conspicuous trigones. Underleaves large, broader than the stem, or very small, ovate to orbicular or reniform, entire or bifid, bifid with a lateral tooth or bisbifid. Plants dioicous. Male inflorescence a short ventral branch, solitary or in pairs or threes, catkin-like, pale to hyaline, the bracts small, bifid, concave. Female inflorescence a short ventral branch, the bracts and bracteoles scale-like. Perigynium fleshy, pendant, cylindrical, of the *Calypogeia* type with scales at the mouth. Sporophyte within the perigynium until maturity, the capsule cylindrical, the valves slender, spirally twisted, the seta (where known) in transverse section of 16 outer cells surrounding about 16 similar cells. Gemmae on erect, radial, small-leaved shoots, green to hyaline, 1- or 2-celled.

Type species: *Calypogeia fissa* (L.) Raddi. [Northern Hemisphere]

Key to the Species

1. Underleaves broadly ovate to orbicular, undivided, retuse or rarely cleft; leaves subrectangular, undivided (subquadrate-retuse in *C. retusa*, broadly triangular, long decurrent in *C. boliviana*).
    2. Leaves broadly triangular, long decurrent. 10. *C. boliviana*.
    2. Leaves subquadrate oblong to long subrectangular.
        3. Leaves strongly asymmetric, bordered by several rows of narrow, elongate cells obliquely overlapping. 1. *C. rhynchophylla*.
        3. Leaves more or less symmetric.

4. Leaves bordered by 1 or 2 rows of cells twice as long as wide, set at a right angle to the margin.
   5. Leaf margin deeply crenulate.
      6. Leaves subquadrate, retuse, patent. 3. *C. retusa.*
      6. Leaves subrectangular, widely spreading. 2. *C. cellulosa.*
   5. Leaf margin only weakly crenulate or entire.
      6. Leaf cells with large trigones; plants brownish. 4. *C. elliottii.*
      6. Leaf cells thin-walled, without trigones; plants olive-green. 5. *C. caespitosa.*
4. Leaves bordered by mostly smaller quadrate cells, or cells wider than high, or not conspicuously bordered.
   5. Leaf margin coarsely crenulate.
      6. Leaves subquadrate, retuse, patent. 3. *C. retusa.*
      6. Leaves subrectangular, truncate or rounded. 6. *C. crenulata.*
   5. Leaf margin only weakly crenulate or entire.
      6. Cells of the underleaf similar to those of the leaf; underleaf shortly cleft, the segments broad, rounded, the margin crenulate. 11. *C. nephrostipa.*
      6. Cells of the underleaves elongate, often hyaline, different from the leaf-cells.
         7. Underleaves with some teeth or spines at the apices.
            8. Teeth long, triangular or spinose. 8. *C. parallelogramma.*
            8. Teeth very short, often only as cell projections. 12. *C. fissistipula.*
         7. Underleaves without teeth, the margins often crenulate from projecting cell walls.
            8. Leaves weakly bordered by somewhat smaller cells; cells with knot-like trigones. 7. *C. venezuelana.*
            8. Leaves not bordered; cell walls mostly uniformly thickened, the trigones very small. 9. *C. cyclostipa.*

1. Underleaves bifid, with or without supplementary teeth or projections on the lateral margins, or bisbifid (4-divided with the middle sinus deepest).
   2. Underleaves bifid, with or without a broad tooth or projection on each side.
      3. Underleaves bifid, without supplementary teeth.
         4. Leaves oblong, subrectangular, the apex broad, rounded.
            5. Underleaves divided to near the base, the segments narrowly ovate, divergent. 19. *C. tenax.*
            5. Underleaves divided to the middle or less, the segments broad, rounded, erect. 11. *C. nephrostipa.*
         4. Leaves ovate, the apices acute or shortly bifid.
            5. Leaf apices acute or mucronate.
               6. Underleaves scarcely broader than the stem.
                  7. Leaves strongly asymmetric, the dorsal side short. 21. *C. rhombifolia* var. *colombica.*
                  7. Leaves symmetric.
                     8. Leaves mucronate. 17. *C. andicola.*
                     8. Leaves blunt-ovate. 16. *C. subintegra.*
               6. Underleaves to 3 times as broad as the stem. 15. *C. grandistipula.*
            5. Leaf apices shortly bifid.
               6. Leaves strongly asymmetric, subquadrate, the dorsal margin straight, the ventral margin longer, convex.
                  7. Leaves mostly bifid; cells of the dorsal margin and interior to 50 μ long. 20. *C. rhombifolia.*
                  7. Leaves mostly mucronate, occasionally bifid; cells of the dorsal margin and interior long narrow, to 117 μ long. 21. *C. rhombifolia* var. *colombica.*
               6. Leaves more or less symmetric, ovate.
                  7. Leaves about half as long as broad; underleaves with a shallow, broad lunulate sinus and broad, rounded segments. 14. *C. oblata.*
                  7. Leaves longer than broad.
                     8. Cells of the underleaf segments long-rectangular; leaf cells smaller, hexagonal. 18. *C. uncinulatula.*

        8. Cells of the underleaf segments essentially similar to those of the upper part of the leaf; underleaf deep-set on the stem.
          9. Underleaves 3 or 4 times as broad as the stem. 15. *C. grandistipula.*
          9. Underleaves scarcely broader than the stem. 16. *C. subintegra.*
  3. Underleaves bifid and with one or more large projections on the margins, or with teeth or spines near the apex.
    4. Underleaves with a large projection or tooth (rarely several) on the lateral margins, deep-set (decurrent) on the stem.
      5. Underleaves very large, imbricate, 3 or 4 times as wide as the stem. 15. *C. grandistipula.*
      5. Underleaves smaller, rarely more than twice as wide as the stem; cells of the upper part of the leaf hexagonal, thin-walled, without trigones; stem tips often becoming erect, gemmiparous. 13. *C. peruviana.*
    4. Underleaves with at least a few teeth and spines along the upper part, transversely inserted on the stem; leaves long-rectangular, undivided.
      5. Segments ending in a long, triangular spinose tooth; leaf cells thin-walled. 8. *C. parallelogramma.*
      5. Segments broad, rounded with a few short spines along the top; leaf cells with conspicuous trigones. 12. *C. fissistipula.*
2. Underleaves bisbifid (4-divided with the middle sinus deepest); leaves bordered, at least in the lower half (sometimes weakly so).
  3. Leaves of well developed stems symmetric or nearly so, typically long, orbicular to oblong-ovate; (leaves of one side of the stem often smaller and deformed for a distance.)
    4. Leaf apex broad, shortly bifid, the teeth mucronate, 1 or 2 cells long. 26. *C. amazonica.*
    4. Leaf apex bifid, the teeth triangular, several cells wide at the base, the sinus V- or U-shaped. 27. *C. miquelii.*
  3. Leaves asymmetric.
    4. Leaves bordered below by a row of long, narrow cells with oblique, overlapping ends.
      5. Border cells 130–230 μ long, with very long overlapping end walls. 24. *C. steyermarkii.*
      5. Border cells 78–104 μ long, with short, overlapping ends. 23. *C. lechleri.*
    4. Leaves bordered by quadrate or rectangular cells with truncate ends.
      5. Leaves conspicuously falcate, the segments pointing downward. 28. *C. falcata.*
      5. Leaves spreading or ascendant.
        6. Underleaves small, not wider than the stem; teeth of leaves 1 or 2 cells long, separated by a narrow, lunulate sinus. 25. *C. laxa.*
        6. Underleaves conspicuous, wider than the stem.
          7. Underleaves truncate-ovate with convex sides; teeth of the leaves ascendant. 22. *C. densifolia.*
          7. Underleaves cuneate; teeth of the leaves straight, often triangular from a broad base. 29. *C. lophocoleoides.*

1. Calypogeia rhynchophylla (Herzog) Bischler, Candollea **18**: 26. *f. 6.* 1962.

Mnioloma rhynchophylla Herzog, Ann. Bryol. **3**: 115. *f. 1–4.* 1930.

Plants large, yellow-green to olive-green, prostrate, caespitose; stems large, 3–5 cm long, with leaves, 2–3.8 mm wide, sparingly irregularly branched; branches ventral, axillary-intercalary, leafy or rarely flagelliform or sexual. Rhizoids few, long hyaline, from small basal cells of the underleaves. Line of leaf insertion oblique, nearly longitudinal. Leaves widely spreading, bordered, subimbricate, asymmetric, long ovate, the dorsal margin often straight from a curved base, the ventral margin strongly arched above from a slightly decurrent base, the apical end broad, often truncate, mucronate; leaf border conspicuous, of 2–4 obliquely overlapping thick-walled cells 100–150 × 10–13 μ, with tapering ends, extending from the base and forming the mucronate tip; cells of the upper part of the lamina 20–40 × 13–26 μ, thin-walled, the trigones small or absent, the cuticle coarsely verruculose. Underleaves broader than the stem, broadly ovate to suborbicular, the apex rounded to blunt-pointed or shortly bifid, bordered by long cells as in the leaf, the lamina of shorter, thin-walled cells of similar texture. Plants dioicous. Male inflorescence on a short sexual branch, bud-like, single or rarely two or three in the axil of an underleaf, the male bracts and bracteoles in 4 or 5 series, the bracts small, bifid, concave. Antheridia one to three in the axil of a bract. Female inflorescence and sporophyte not seen.

Pl. 66. Fig. 1, a–c.

Habitat: in mats on bark of trees.

COSTA RICA: Cartago: Orosi, 1000 m, *Standley 39843* (type Hb Herzog).

2. Calypogeia cellulosa (Sprengel) Stephani, Spec. Hep. **3**: 398. 1908.

Jungermannia cellulosa Sprengel, Syst. Veg. **4**: 232. 1827.
Mastigobryum cellulosum Lindenberg in G. L. & N. Syn. Hep. 217. 1845.
Kantia cellulosa (Sprengel) Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 412. 1885.
Jungermannia cellularis Sprengel, in Hb.

Plants of small to medium size, olive-green becoming yellowish, in depressed mats or among other bryophytes; stems to 2 cm or more long, with leaves, to 1.5 mm wide, irregularly branched; branches ventral-intercalary, one or two from the axil of an underleaf, leafy or more rarely flagelliform or short sexual. Rhizoids occasional, long, bulbous or branched at the tips, often brownish, in tufts from small cells on the base of an underleaf. Line of leaf insertion slightly oblique, nearly longitudinal. Leaves approximate to imbricate, bordered, widely spreading, tending to be slightly falcate, plane or becoming decurved in the outer part, more or less rectangular in outline, 0.6–0.7 × 0.4–0.5 mm, the dorsal base scarcely curved, the ventral base long decurrent, the apex broad, truncate-rounded, the margin deeply crenulate; leaf border a row of cells elongate at a right angle to the margin, the cells to 40 × 15–20 μ; cells of the apical region 30–45 × 25–33 μ, the walls uniformly thickened, the trigones tiny or absent, the cuticle papillose. Underleaves orbicular, often twice as wide as the stem, undivided to retuse, the cells large, the margin entire or crenulate. Plants dioicous. Female inflorescence solitary or in pairs, the bracts and bracteoles in 3 or 4 series, small; archegonia five to ten. Perigynium, sporophyte and male inflorescence not seen.

Pl. 66. Fig. 2, a–e.

Habitat: In mats or among other bryophytes, on trees and decayed logs in forests.

CUBA: Oriente: Sierra Maestra, 1100–1400 m, *Ekman* (S-PA)
PUERTO RICO: Pico del Oeste, 1020 m, *Fulford, Crandall, Stotler 406* p.p. (Hb Fulford).
WEST INDIES: s.l., *Perrin* (NY, PHILA).
GUADELOUPE: without data (NY, S-PA); s.l. *Perrin* (lectotype G-1844; BM, NY, S-PA); ex Hb Hooker (NY); s.l., *Parker* (NY); s.l., as *J. cellularis* (S-PA).
DOMINICA: Caulisbon, 3700 ft, *Elliott 1901* (BM); Morne Micotrin, 3000–3800 ft, *Elliott* (BM); Morne Trois Pitons, *Elliott 2276*, *2290* ♂ (BM, G), *2294B* (BM).

3. Calypogeia retusa Bischler, Candollea **18**: 33. *f. 8*. 1962.

Plants of medium size, yellowish-green becoming brownish, in mats or among other bryophytes; stems creeping, slender, to 5 cm long, with leaves, to 1.7 mm wide; branches frequent, leafy or flagelliform, ventral, axillary-intercalary; stem in transverse section of thin-walled cells. Rhizoids abundant, long, in hyaline tufts

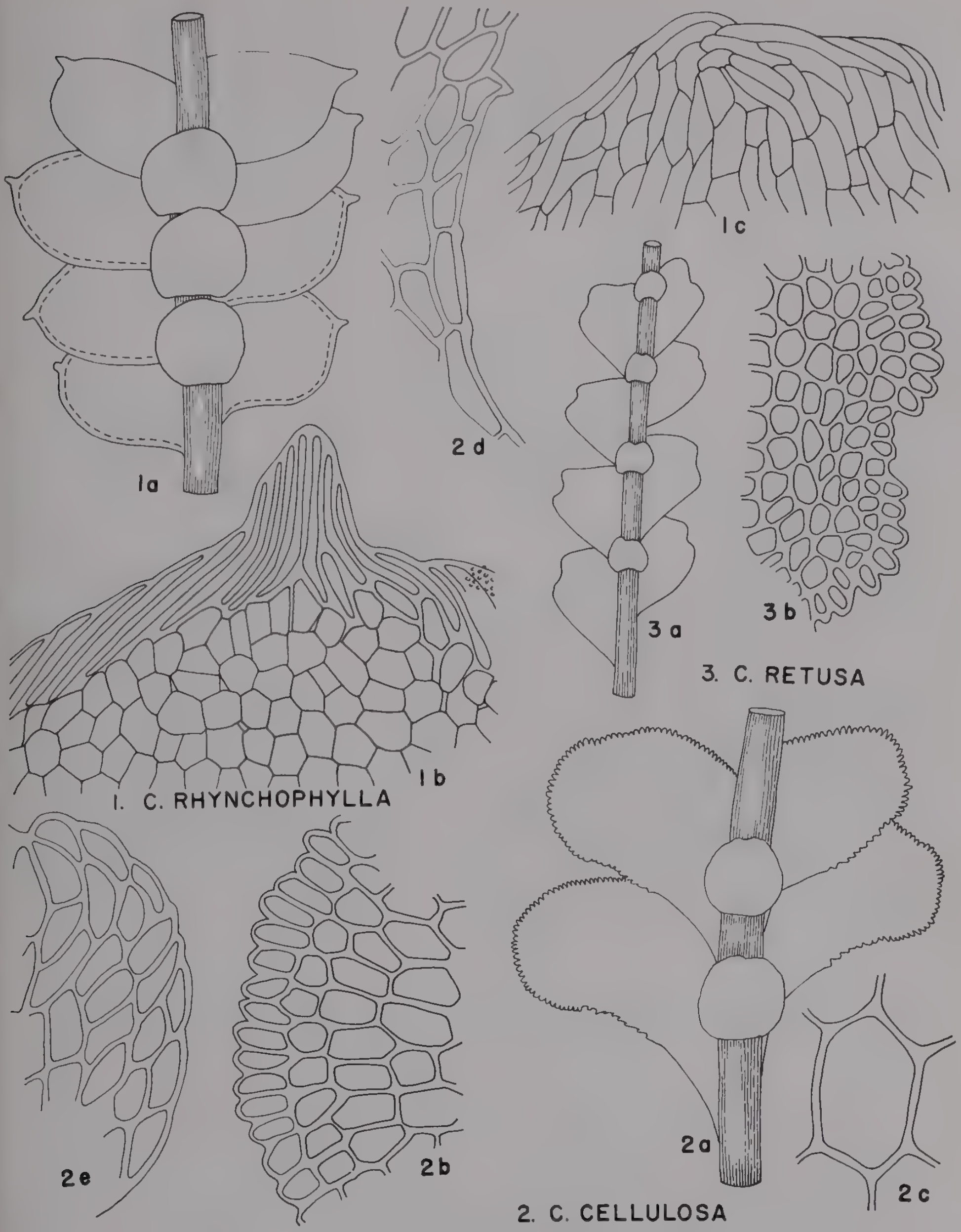
2 d
1 c
1a
3 a
3 b
3. C. RETUSA
1 b
I. C. RHYNCHOPHYLLA
2e
2b
2a
2 c
2. C. CELLULOSA

Plate 66

FIG. 1. *Calypogeia rhynchophylla.* 1 a. Stem, ventral view, × 35. 1 b. Apical part of a leaf, × 200. 1 c. Upper part of an underleaf, × 200. Drawn from the type.

FIG. 2. *C. cellulosa.* 2 a. Stem, ventral view, × 37. 2 b. Apical part of a leaf, × 200. 2 c. Cell from the upper part of a leaf, × 500. 2 d. Cells of the ventral basal margin of a leaf, × 200. 2 e. Part of an underleaf, × 200. Drawn from the lectotype.

FIG. 3. *C. retusa.* 3 a. Stem, ventral view, × 13. 3 b. Apical margin of a leaf, × 130. After Bischler, 1962, with permission of the Editor of Candollea.

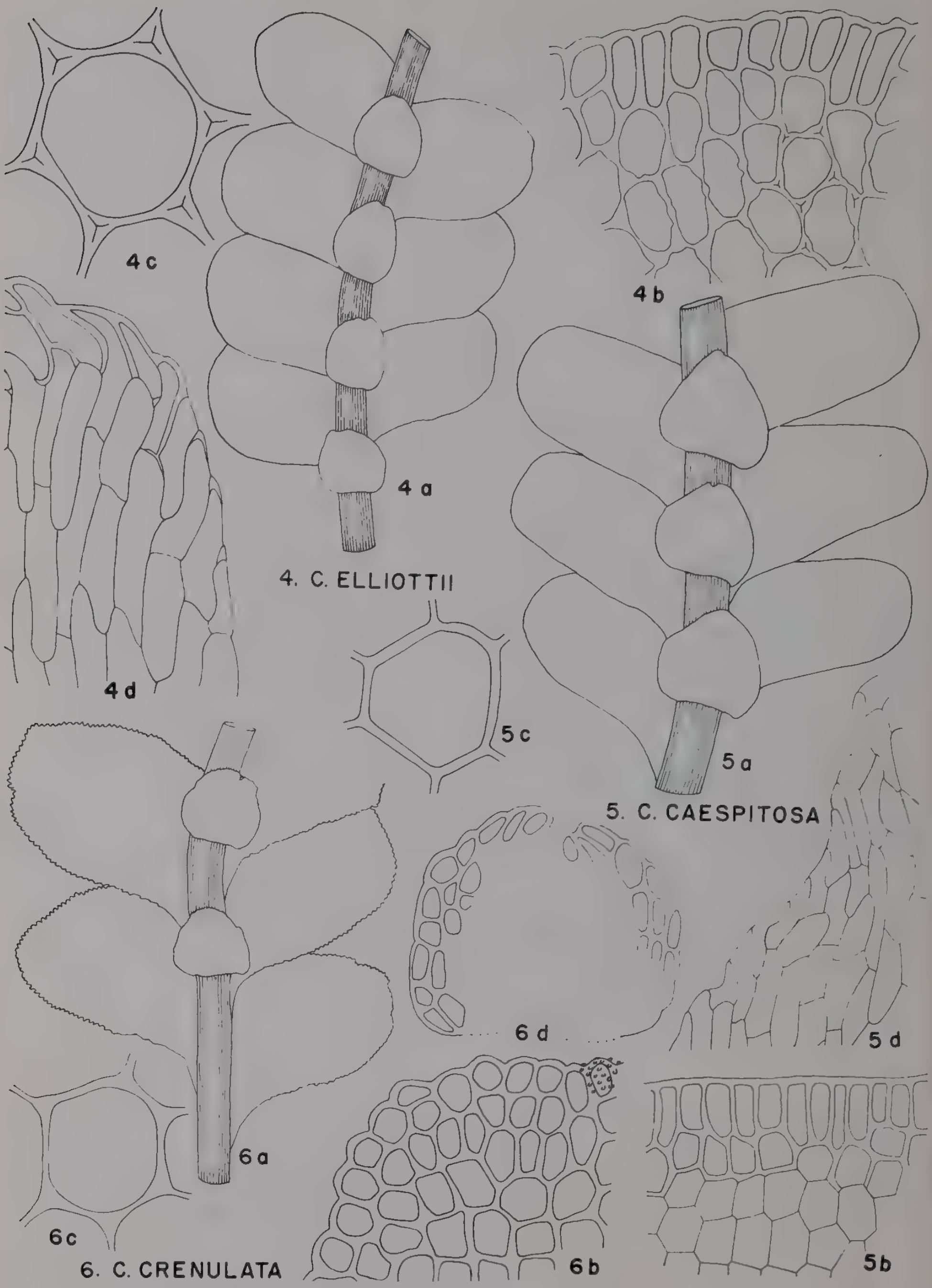
4 c
4 b
4 a
4 d
4. C. ELLIOTTII
5 c
5 a
5. C. CAESPITOSA
6 d
5 d
6 a
6 c
6. C. CRENULATA
6 b
5b

Plate 67

FIG. 4. *Calypogeia elliottii.* 4 a. Stem, ventral view, × 20. 4 b. Portion of the apical margin of a leaf, × 200. 4 c. Cell of the upper part of a leaf, × 500. 4 d. Upper portion of an underleaf, × 200. Drawn from *Elliott 2236.*

FIG. 5. *C. caespitosa.* 5 a. Stem, ventral view, × 20. 5 b. Portion of the apical margin

from the bases of the underleaves. Line of leaf insertion oblique, nearly longitudinal. Leaves subquadrate, retuse, bordered, plane, 0.8 mm long, 0.9 mm wide, the dorsal base curved, the ventral base strongly decurrent, the apex broad, the margin strongly crenulate, of a row of elongate cells; cells of the upper part of the leaf 34 × 25 μ, the walls thin, the trigones small, the cuticle papillose. Underleaves broadly ovate to orbicular, wider than the stem, the cells thin-walled, without trigones, the margin crenulate, the apex often retuse or shortly bidentate. Inflorescences, perigynium and sporophyte not seen.

Pl. 66. Fig. 3, a, b.

Habitat: In mats on bark.

PERU: S. Gavan, *Lechler* (type G-1851).

4. **Calypogeia elliottii** Stephani, Spec. Hep. **3**: 395. 1908.

Plants of medium to large size, deeply pigmented, yellow-brown to dark brown, in depressed mats or among other bryophytes; stems coarse, to 5 cm long, with leaves, 1.5–2 mm wide, rarely branched; branches leafy, ventral, axillary-intercalary; stem in transverse section with a brown unistratose cortical layer of thick-walled cells surrounding the medulla of cells with thinner walls. Rhizoids scarce, long, brownish, in tufts from small cells of the bases of underleaves. Line of leaf insertion oblique, nearly longitudinal. Leaves oblong, subimbricate, bordered, widely spreading, plane or decurved in the outer part, 0.9–1.0 × 0.8–0.85 mm, the apex broad-rounded, the dorsal base slightly curved, the ventral base shortly decurrent, the margin more or less weakly crenulate; leaf border of 1 or 2 rows of long-rectangular cells elongate at a right angle to the leaf margin, 33–45 × 15–25 μ, the walls uniformly thickened; cells of the upper part of the leaf 33–50 × 30–40 μ, the walls thin with conspicuous elongate trigones and occasional intermediate thickenings, the cuticle punctate, becoming striolate in the basal cells. Underleaves large, long-ovate, the base twice as wide as the stem, the apex often tapering, very shortly cleft, the cells long, thin-walled, the margin entire to crenulate. Male and female inflorescences, perigynium and sporophyte not seen.

Pl. 67. Fig. 4, a–d.

Habitat: In brown mats on trees.

PUERTO RICO: Pico del Oeste, 1020 m, *Wood* (Hb Fulford).
DOMINICA: without locality, *Elliott 1139* (lectotype G); Morne Micotrin, 3800 ft, *Elliott 1117*, *1143*, *1147C* p.p. (BM); Morne Trois Pitons, *Elliott 2236* p.p., *2288C* (BM).

5. **Calypogeia caespitosa** (Spruce) Stephani, Spec. Hep. **3**: 397. 1908.

Kantia caespitosa Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 412. 1885.

Plants of medium to large size, olive-green tinged with brown, in tufts or depressed mats; stems to 5 cm long, with leaves, to 3 mm wide, irregularly distantly pinnate; branches leafy, frequent, ventral-intercalary, usually solitary from the axil of an underleaf; stem in transverse section with a unistratose cortical layer of brownish thick-walled cells surrounding the medulla of thin-walled cells. Rhizoids infrequent, long brownish with branched tips, in tufts from small cells of the bases

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of a leaf, × 200. 5 c. Cell from the upper part of a leaf, × 500. 5 d. Portion of an underleaf, × 200. Drawn from the type.

FIG. 6. *C. crenulata*. 6 a. Stem, ventral view, × 37. 6 b. Upper portion of a leaf, × 200. 6 c. Cell from the upper part of a leaf, × 500. 6 d. Underleaf, × 120. Drawn from the type.

of underleaves. Line of leaf insertion oblique, nearly longitudinal. Leaves approximate to subimbricate, bordered, widely spreading, tending to be ascendant, plane, often becoming decurved in the outer part, more or less rectangular, 1.3 × 0.6–0.95 mm, the apex broad-rounded, the dorsal base curved, the ventral base decurrent, the margin entire; leaf border of 1 or 2 rows of long-rectangular cells 30–45 × 15–20 μ, elongate at a right angle to the leaf margin, the walls thickened; cells of the upper part of the leaf mostly 30–40 × 20–25 μ, the walls uniformly thickened, without trigones, the cuticle verrucose, becoming striolate in the lower part of the leaf. Underleaves broadly ovate, twice as broad as the stem at the base, tapering to a blunt, rounded, often retuse apex, the margin straight or crenulate from projecting cell angles, the cells thin-walled. Plants dioicous. Female inflorescence with 2–5 series of short bracts and bracteoles. Male inflorescence, perigynium and sporophyte not seen.

Pl. 67. Fig. 5, a–d.

Habitat: In mats on trees and rocks or hanging from twigs, in montane forests.

COLOMBIA: Meta: Cordillera La Macarena, quebrada Tiranas, 1700 m, *Schultes & Bell 11638* (FH); near Buenaventura, Valle de Cauca, 600 m, *Bischler 443A* (G); Norte de Santander: near Las Mercedes, 1000 m, *Bischler 2573*, *2591A*, *2669B* (G).

VENEZUELA: Amazonas: Cerro Huachamacari, 1200 m, Río Cunucunuma, *Maguire, Cowan & Wurdack 29924* p.p. (NY).

BRAZIL: ad flumen Uaupés prope Panuré, *Spruce* (MANCH).

ECUADOR: Andes Quitenses: Canelos, 1000 m, *Spruce, Hep. Spruc.* (type MANCH, isotypes BM, G, NY, Y); Río Pastaza, *Steyermark 54860* p.p. (F).

6. **Calypogeia crenulata** Bischler, Candollea **18**: 35. *f. 9.* 1962.

Mastigobryum cellulosum var. β. Lindenberg in G. L. & N. Syn. Hep. 217. 1845.

Plants of medium to large size, olive-green to dark brown, in depressed mats or scattered among other bryophytes; stems 3–5 cm long, with leaves, 1.5–2 mm wide, sparingly irregularly branched; branches leafy, ventral-intercalary, single or in pairs from the axils of the underleaves; stem in transverse section with a brown unistratose layer of thick-walled cells surrounding the medulla of many cells with thinner brown to hyaline walls. Rhizoids abundant, in tufts from small basal cells of some underleaves, long, brownish, branched at the tips. Leaf insertion slightly oblique, nearly longitudinal. Leaves approximate to subimbricate, bordered, rectangular, widely spreading, straight or ascendant, plane or decurved in the outer part, 0.6–0.85 × 0.3–0.5 mm, the dorsal base curved, the ventral base decurrent, the apex broad, rounded, the margin crenulate; leaf border of 1 (more rarely of 2) row of quadrate cells 20–25 × 20–25 μ occasional cells, to 60 × 20 μ, the walls uniformly thickened; cells of the apical region 25–39 × 25 μ long and broad, the walls thin or uniformly thickened, the trigones small to conspicuous, the cuticle papillose-warty. Underleaves orbicular to truncate-ovate from a broad base, twice as wide as the stem, scarcely tapering above, the rounded apex often retuse, the cells elongate, thick-walled, the margins crenulate. Plants dioicous. Male inflorescence short, bud-like, delicate, the bracts and bracteoles in 3 or 4 series, the bracts similar to the underleaves, smaller; antheridia not seen. Female inflorescence very short, the bracts and bracteoles in 3 or 4 series, scale-like, remaining at the mouth of the perigynium. Pendant perigynium club-shaped, to 2.5 mm long, 0.8 mm broad. Sporophyte not seen.

Pl. 67. Fig. 6, a–d.

Habitat: On trees, rocks and decaying logs in montane forests.

CUBA: Oriente: Sierra Maestra, 1100–1400 m, *Ekman* (UPS).

JAMAICA: path to Morce's Gap, *Evans 47* (Y); road from Morce's Gap to Vinegar Hill, *Underwood 1375* (NY, Y); Newhaven Gap, 5500 ft, *Underwood 1066* (NY, Y).

ST. KITTS: s.l., Breutel (type S-PA, G, NY [as 'West Indies']); Mt. Misery, *N. L. Britton & Cowell 531* (NY, Y).

GUADELOUPE: s.l. or without coll., ex Hb Hooker (NY), s.l., *l'Herminier* (BM).

COLOMBIA: Bogotá, Hb Mitten (NY).

BRAZIL: s.l., *Glaziou 9032* (NY). S. Paulo: Alto da Serra, 900 m, *Schiffner 404* p.p., *406* (W, UPS).

ECUADOR: Tungurahua: Cordillera de los Torres, *Asplund* (S-PA); Río Timbara, *Krause* (S-PA).

PERU: S. Gavan, *Lechler* (S-PA); Tatanera, *Lechler* (S-PA); Lachapola, without coll. (BM).

7. **Calypogeia venezuelana** Fulford, sp. nov.

Caules foliosi 1–3 cm longi, fulvi; folia plana, subrectangularia, margine e cellulis parvioribus constato; foliorum cellulae 25–39 × 25 μ, trigonis magnis parietibus convexis, cuticula verrucosa. Amphigastria orbicularia indivisa vel raro retusa. Inflorescentiae non visae.

Plants of small to medium size, prostrate, in yellow-brown mats or scattered among other bryophytes; stems to 3 cm long, with leaves, to 1.5 mm or more broad, occasionally branched; branches short, leafy or rarely flagelliform, ventral-intercalary from the axils of the underleaves. Rhizoids frequent, long, the tips enlarged or branched, in brownish tufts from the lower parts of underleaves. Line of leaf insertion oblique, slightly curved above. Leaves subimbricate, bordered by smaller cells, widely spreading, plane or becoming decurved in the outer part, subrectangular in outline, 0.6–0.9 × 0.45–0.6 mm, the dorsal base curved, the ventral base shortly decurrent, the apex broad-rounded, the margin often weakly crenulate, coarsely papillose, and thickened above each cell lumen; cells of the border 20–26 × 15–20 μ, the walls thickened; cells of the upper part of the leaf mostly 26–39 × 25 μ, the walls thin, the trigones large, conspicuous, with bulging sides, the cuticle coarsely warty. Underleaves orbicular, twice as broad as the stem, sometimes narrowed to the blunt, rounded apex, the margin crenulate, the cells large, elongate, thick-walled, the trigones large. Male and female inflorescences and sporophyte not seen.

Pl. 68. Fig. 7, a–d.

Habitat: On rocks and moist cliff faces.

VENEZUELA: Amazonas: Serrania Parú, *Cowan & Wurdack 31427* (type NY) Bolívar: Cerro Venamo, escarpment, 1500 m, *Steyermark & Dunsterville 92595* p.p. (VEN); near Salto de Pacairao, 1220 m, *Steyermark 60519a* (F).

8. **Calypogeia parallelogramma** (Spruce) Stephani, Spec. Hep. **3**: 296. 1907.

Kantia parallelogramma Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 413. 1885.
Kantia trichomanis var. *β granulosa* Wright, in Hb.

Plants of medium to large size, dark green becoming dark brown to blackish, in depressed mats; stems to 5 cm long, with leaves, to 2 mm wide, irregularly pinnate; branches solitary, ventral-intercalary in the axils of the underleaves, leafy or rarely flagelliform or short sexual. Rhizoids occasional, tinged with brown, long, the tips branched, in tufts from small cells of the lower part of the underleaf. Line of leaf insertion oblique. Leaves approximate to subimbricate, more or less bordered by a row of smaller cells, widely spreading, plane, subrectangular, 0.9 × 0.48 mm, the apex broad-rounded or rarely retuse, the dorsal base curved, the ventral base

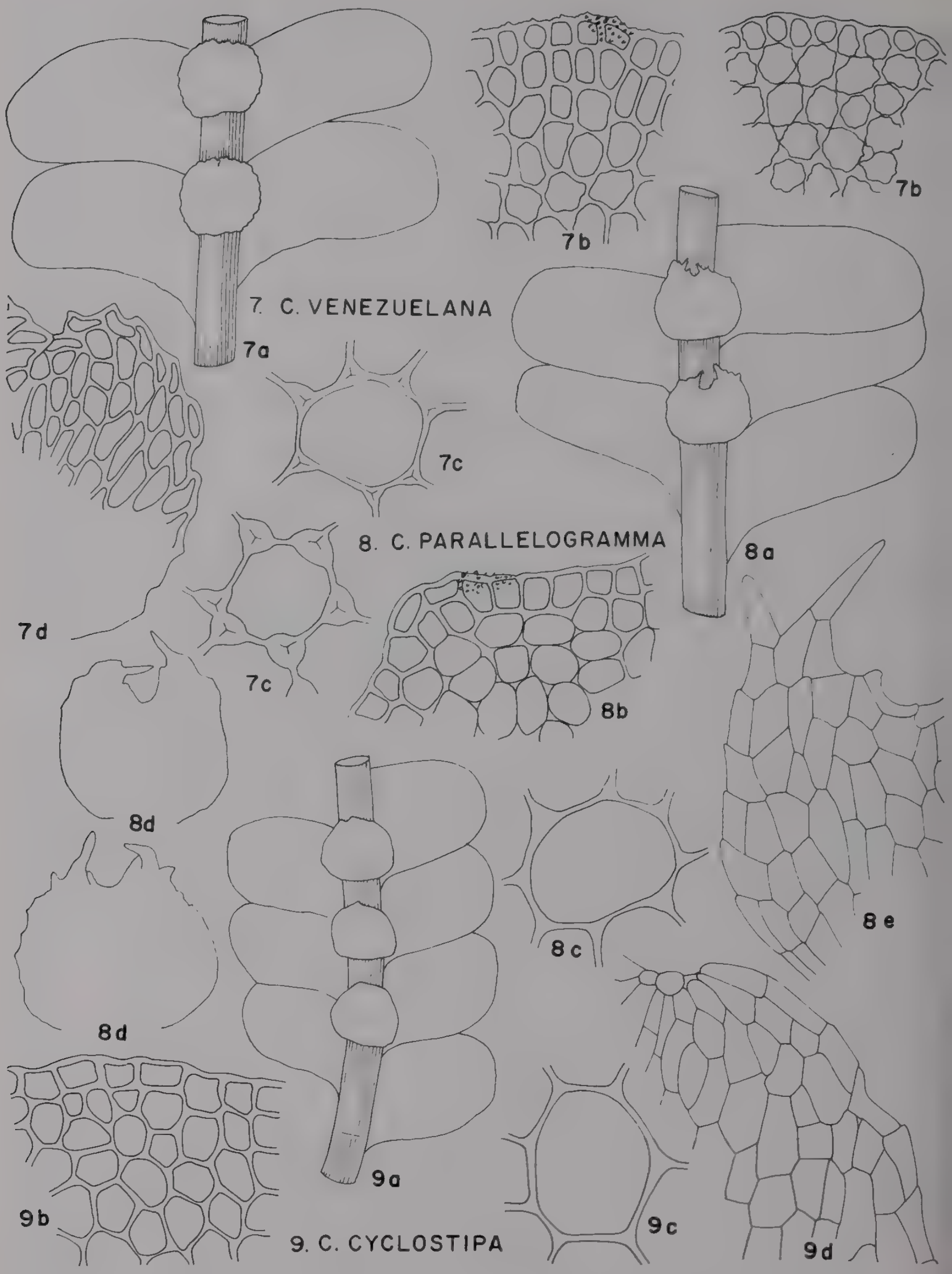
7 C. VENEZUELANA
7a
7b
7b
7c
7c
7d
8. C. PARALLELOGRAMMA
8a
8b
8c
8d
8d
8e
9. C. CYCLOSTIPA
9a
9b
9c
9d

Plate 68

FIG. 7. *Calypogeia venezuelana.* 7 a. Stem, ventral view, × 37. 7 b. Portion of the upper part of a leaf, × 200. 7 c. Cell from the apical part of a leaf, × 500. 7 d. Portion of an underleaf, × 200. Drawn from the type.

FIG. 8. *C. parallelogramma.* 8 a. Stem, ventral view, × 37. 8 b. Portion of the apical part

decurrent, the leaf margin entire, undulate and with a suggestion of blunt teeth, especially along the dorsal margin; cells of the border quadrate or wider than long, often conspicuous on the upper margin, variable, 15–25 μ high, 20–30 μ wide, the walls uniformly thickened; cells of the apical region mostly 25–39 × 25–30 μ, the walls thin, the trigones small, distinct, the cuticle punctate. Underleaves broadly ovate to orbicular, twice as broad as the stem, the apex broad, cleft, the segments ending in a tooth 1–4 cells long. Male and female inflorescences and sporophyte not seen.

Pl. 68. Fig. 8, a–e.

Habitat: On shaded rocks, damp soil and decayed logs in forests.

CUBA: s.l., *Wright* (♂), type of *C. trichomanis* var. β *granulosa* (G-1821).

JAMAICA: s.l., *Marsh* (NY).

COLOMBIA: Amazonas: Río Miritiparaná, Caño Guacayá, 700 ft, *Schultes & Cabrera 15792* (FH). Vaupés: Río Vaupés, 2500 m, *Schultes & Cabrera 13943* (FH).

VENEZUELA: Bolívar: Sierra Ichún, 625–725 m, *Steyermark 90210* p.p., *90211*, *90212*, *90213* (VEN).

BRAZIL: flumen Uaupés, Panuré, *Spruce*, *Hep. Spruc.* (type MANCH-Kk 1707, isotypes BM, MANCH, NY, S-PA, Y). S. Paulo: Alto da Serra, 900 m, *Schiffner 404* p.p. (W, Hb Fulford).

9. **Calypogeia cyclostipa** (Spruce) Stephani, Spec. Hep. **3**: 396. 1908.

Kantia cyclostipa Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 411. 1885.

Plants of medium to large size, olive-green tinged with brown, in depressed mats; stems to 5 cm long, with leaves, to 2.5 mm wide, occasionally branched; branches ventral-intercalary, leafy or rarely flagelliform or short sexual, solitary in the axils of the underleaves; stem in transverse section with a unistratose layer of brownish thick-walled cells surrounding the medulla of hyaline thin-walled cells. Rhizoids in tufts, long, hyaline to brownish, from small cells of the basal part of the underleaves and from the scale-leaves of the flagelliform branches. Line of leaf insertion oblique, nearly horizontal. Leaves not bordered or appearing so only here and there, approximate to subimbricate, widely spreading, plane, often becoming decurved in the outer part, more or less rectangular in outline, to 1.0 × 0.8 mm, the apex broad-rounded, the dorsal base curved, the ventral base shortly decurrent, the leaf margin entire; marginal cells 20 × 26 μ, or some longer, 32 × 26 μ, cells of the apical region mostly 25–36 × 26–30 μ, the walls thin, the trigones inconspicuous to small, the cuticle verruculose. Underleaves broadly ovate, below twice as broad as the stem, tapering to a blunt-rounded, retuse or shortly cleft apex, the cells long, thin-walled. Plants dioicous. Female inflorescence solitary, the bracts and bracteoles in 2 or 3 series, scale-like, remaining at the tip of the 2.5–3 mm long, club-shaped perigynium. Male inflorescence not seen.

Pl. 68. Fig. 9, a–d.

Habitat: In mats on soil, prop roots and trees in humid montane forests.

COLOMBIA: Metá: Cordillera La Macarena, Caño Tiranas, 1700 m, *Schultes 11233* p.p. (FH). s.l., *Moritz* (G-1831).

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of a leaf, × 200. 8 c. Cell from the upper part of a leaf, × 500. 8 d. Underleaf, × 70. 8 e. Portion of an underleaf, × 200. Drawn from the type.

Fig. 9. *C. cyclostipa.* 9 a. Stem, ventral view, × 20. 9 b. Portion of the apical part of a leaf, × 200. 9 c. Cell of the upper part of a leaf, × 500. 9 b. Portion of an underleaf, × 200. Drawn from the type.

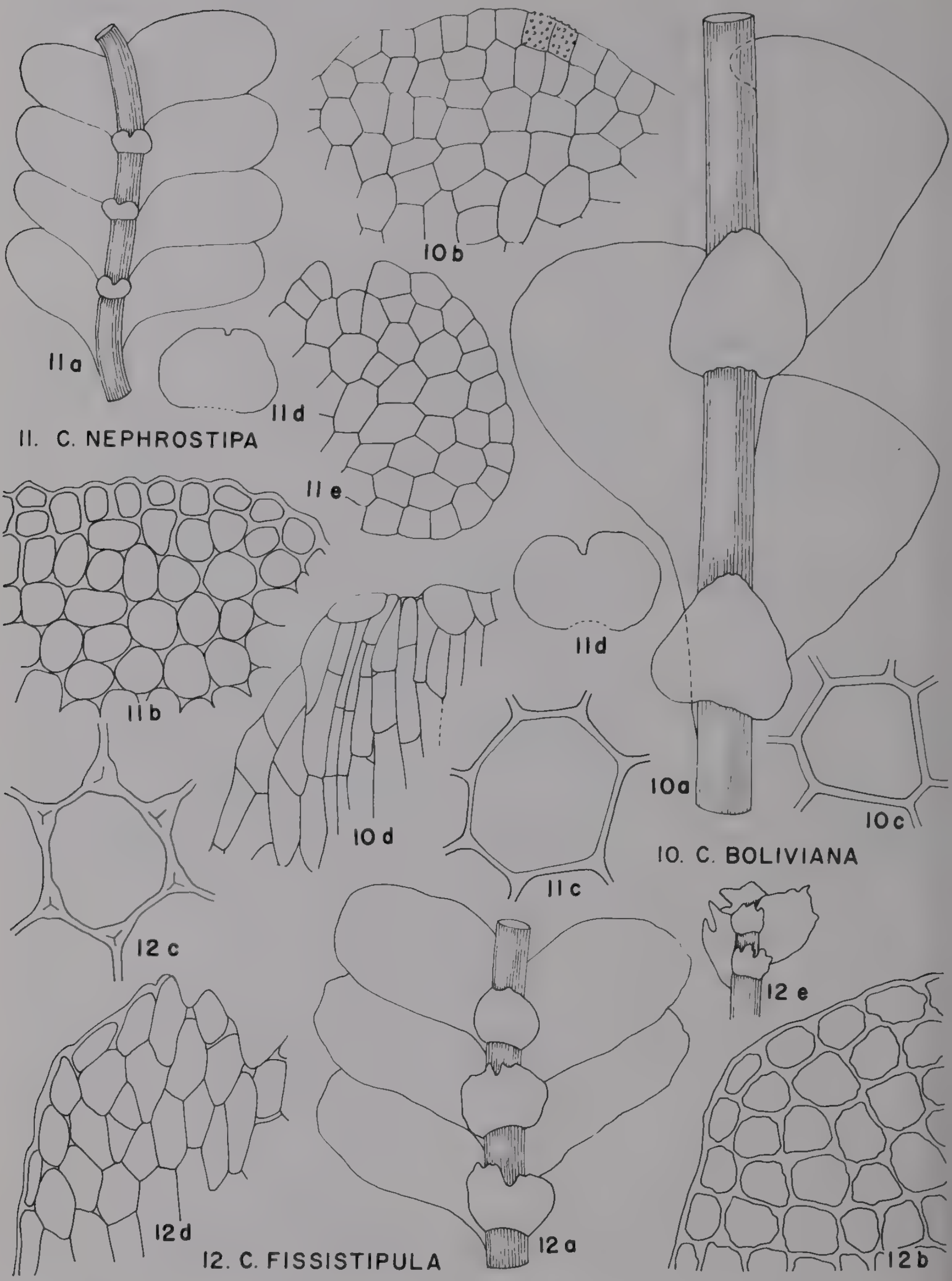
11a
10b
11d
11. C. NEPHROSTIPA
11e
11b
11d
10a
10c
10. C. BOLIVIANA
10d
11c
12c
12e
12d
12. C. FISSISTIPULA
12a
12b

Plate 69

Fig. 10. *Calypogeia boliviana.* 10 a. Stem, ventral view, × 37. 10 b. Portion of the upper part of a leaf, × 200. 10 c. Cell from the upper part of a leaf, × 500. 10 d. Portion of an underleaf, × 200. Drawn from the type.

Fig. 11. *C. nephrostipa.* 11 a. Stem, ventral view, × 37. 11 b. Portion of the upper margin

VENEZUELA: s.l., *Fendler* (G). Amazonas: Cerro Huachamacari, Río Cunucunuma, 1400 m, *Maguire, Cowan & Wurdack 30333* (NY).

BRAZIL: Itatiaia Park, Rio Marombas falls, 1100 m, *Fulford, Hatcher, Hell & Vital 742* p.p., *763* p.p., *795* p.p. (Hb Fulford).

ECUADOR: Tungurahua, *Spruce* (neotype MANCH-Kk 690); s.l., *Spruce* (NY).

PERU: s.l., *d'Orbigny* (G-1832); Río Huallaga, Cerro de Esculer, 1200 m, *Ule* [1903] *595* (G).

BOLIVIA: Songo, *Bang 895A* (MANCH); lower Río Pelechuco, 3000 ft, *Williams 2737* (NY, Y).

10. **Calypogeia boliviana** Fulford, sp. nov.

Caules foliosi ad 3 cm longos, olivacei; folia late triangularia, longe decurrentia, apice obtuso rotundato; foliorum cellulae superiores 26–40 × 20–26 μ, parietibus tenuibus; amphigastria late ovata, apice rotundato vel retuso, cellulis longis; inflorescentiae non visae.

Plants of medium size, olive-green, in thin mats or scattered among other bryophytes; stems to 3 cm or more long, with leaves, to 2 mm wide, occasionally branched; branches leafy, long, ventral-intercalary in the axils of the underleaves. Rhizoids occasional, short, in light yellowish tufts from near the bases of the underleaves. Leaf insertion slightly oblique, nearly longitudinal. Leaves distant to approximate, inconspicuously bordered by a row of smaller cells, spreading, asymmetric, broadly triangular, 0.75 mm long, 0.84 mm wide below, the dorsal base curved to cordate, the ventral base very long-decurrent, the apex narrow, blunt-rounded; cells of the border 19–26 × 15–26 μ, thin-walled; cells of the upper part of the leaf 26–40 × 20–26 μ, the walls thin, without trigones, the cuticle punctate. Underleaves ovate, to 0.6 mm long, below twice as broad as the stem, narrowed to the blunt-rounded or retuse apex, the margins entire, the cells long, thin-walled. Male and female inflorescences and sporophyte not seen.

Pl. 69. Fig. 10, a–d.

Habitat: Unknown.

BOLIVIA: Incachaca, 10500 m, *W. Brooke 6728A* (type NY).

11. **Calypogeia nephrostipa** (Spruce) Stephani, Spec. Hep. **3**: 397. 1908.

Kantia nephrostipa Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 412. 1885.
Kantia mastigophora Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 413. 1885.
Calypogeia mastigophora (Spruce) Stephani, Spec. Hep. **3**: 399. 1908.

Plants of medium to large size, olive-green to yellowish, in depressed mats; stems to 6 cm long, with leaves, to 2 mm wide, sparingly to abundantly irregularly pinnate; branches, ventral-intercalary leafy or short sexual. Rhizoids abundant, long, branched at the tips, in light brown tufts from small cells near the bases of underleaves. Leaf insertion slightly oblique, nearly longitudinal. Leaves imbricate, widely spreading to patent, more or less bordered by smaller cells, orbicular to rectangular, 0.95–1.7 mm long, 0.66 mm wide at the middle, the apex broad, truncate-rounded, the dorsal base slightly curved, the ventral base decurrent, the margin crenulate; leaf border of 1 or rarely 2 rows of somewhat smaller, bulging cells, 20–25 × 20–25 μ,

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of a leaf, × 200. 11 c. Cell from the upper part of a leaf, × 500. 11 d. Underleaves, × 70. 11 e. Portion of an underleaf, × 200. Drawn from the type.

FIG. 12. *C. fissistipula*. 12 a. Stem, ventral view, × 40. 12 b. Portion of the upper part of a leaf, × 200. 12 c. Cell from the upper part of a leaf, × 500. 12 d. Portion of an underleaf, × 200. 12 e. Very young ventral branch, × 50. Drawn from the type.

the walls thickened; cells of the upper part of the leaf 30–40 × 30–40 μ, the walls thin, the trigones small, the cuticle punctate. Underleaves orbicular to reniform, wider than the stem, twice as broad as high, shortly bifid with broad rounded lobes, the cells mostly isodiametric, thin-walled, the margin regularly crenulate. Plants dioicous. Male inflorescence a short or long catkin-like branch, the bracts and bracteoles in 3–10 series, scale-like, concave. Female inflorescence short, of 3 or 4 series of scale-like bracts and bracteoles. Perigynium and sporophyte not seen.

Pl. 69. Fig. 11, a–e.

Habitat: On decaying wood, trees, moist rocks and soil in forests.

VENEZUELA: Silva Amazonica, San Carlos, *Spruce*, *Hep. Spruc.* (type MANCH, isotypes BM, G, NY, Y). Bolívar: Chimantá Massif, near Summit Camp, 1925 m, *Steyermark & Wurdack 322* (NY).

BRAZIL: Rio Negro *inter Alobiellum*, *Spruce*, neotype of *K. mastigophora* (G); Rio Negro, *Spruce* (NY).

12. **Calypogeia fissistipula** Bischler, Candollea **18**: 47. *f. 15.* 1962.

Calypogeia nephrostipa Stephani, Spec. Hep. **3**: 397. 1908. p.p. Non *Kantia nephrostipa* Spruce.

Plants of small to medium size, in yellow-green to brown mats; stems to 2 cm long, with leaves, to 3.5 mm broad, irregularly branched; leafy branches, to 1 cm long, ventral-intercalary from the axils of the underleaves, sexual branches short. Rhizoids numerous, in hyaline tufts from small cells of the lower part of the underleaves. Leaves imbricate, weakly bordered, spreading-ascendant, plane, more or less rectangular, 1.0–1.6 × 0.7–0.9 mm, the apex broad-rounded, the dorsal base curved, the ventral base slightly decurrent; leaf cells of the upper margin 25–34 × 27–30 μ, in places suggesting a border, cells of the upper part of the leaf mostly 30–40 × 26–33 μ, the walls thickened, the trigones conspicuous, with bulging sides, the cuticle papillose. Underleaves more or less orbicular, to twice as broad as the stem, undivided to retuse or conspicuously or even deeply bifid, the cells mostly elongate, thin-walled, the margin obscurely crenulate or occasionally with a 1-celled tooth, not decurrent on the stem. Male and female inflorescences and sporophyte not seen.

Pl. 69. Fig. 12, a–e.

Habitat: In dense mats on bark and decaying logs at low altitudes.

VENEZUELA: s.l., *Fendler* (type G; G-1859, G-1860). Bolívar: Río Tirica, 2090 m, *Steyermark & Wurdack 892* p.p. (NY).

PERU: S. Gavan, *Lechler* (NY).

13. **Calypogeia peruviana** Nees & Montagne in Montagne, Ann. Sci. Nat. II. Bot. **9**: 47. 1838.

Calypogeia abnormis Ångström, Öfvers. Vet.-akad. Förhandl. **33**(7): 80. 1876.
Kantia peruviana (Montagne) Trevisan, Mem. Ist. Lomb. III. **4**: 425. 1877.
Kantia biapiculata Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 414. 1885.
Cincinnulus biapiculatus Stephani in Duss, Fl. Crypt. Antill. Fr. 169. 1903. Nomen nudum.
Kantia portoricensis Stephani, Hedwigia **27**: 280. 1888.
Kantia vincentina Wright, Jour. Bot. London **29**: 107. 1891.
Kantia heterophylla Stephani, Hedwigia **34**: 53. 1895.
Kantia abnormis (Ångström) Stephani, Hedwigia **34**: 56. 1895.
Calypogeia portoricensis (Stephani) Evans, Bryologist **10**: 30. 1907.
Calypogeia biapiculata (Spruce) Stephani, Spec. Hep. **3**: 403. 1908.
Calypogeia dussiana Stephani, Spec. Hep. **3**: 404. 1908 p.p. [excl. *Duss 508*.]
Calypogeia heterophylla (Stephani) Stephani, Spec. Hep. **3**: 407. 1908. Non Stephani, Spec. Hep. **6**: 448. 1924. [from Japan.]

Calypogeia gigantea Stephani, Spec. Hep. **3**: 409. 1908. Non Stephani, Spec. Hep. **6**: 447. 1924. [Nova Guinea.]
Calypogeia vincentina (Wright) Stephani, Spec. Hep. **3**: 411. 1908.
Calypogeia subrotunda Stephani, Bibliot. Bot. **21**(87): 223. *f. 163a.* 1916.
Calypogeia muscicola Stephani, Bibliot. Bot. **21**(87): 223. *f. 163b.* 1916.
Calypogeia heterophylla f. *abnormis* (Ångström) Bischler, Candollea **18**: 67. *f. 19.* 1962.
Calypogeia heterophylla var. *subrotunda* (Stephani) Bischler, Candollea **18**: 69. *f. 19.* 1962.
Calypogeia subintegra var. *dussiana* (Stephani) Bischler, Candollea **18**: 67. *f. 19.* 1962. [*Duss 508.*]

Plants of medium to large size, in yellow-, olive-, or dark green to brownish mats, or among other bryophytes; stems highly variable, to 10 cm long, with leaves, to 4–5 mm wide, often much smaller, often becoming erect, small-leaved and gemmiparous at the tips, irregularly branched; branches scarce to abundant, leafy or flagelliform, or short sexual, ventral-intercalary from the axils of the underleaves; stem in transverse section with the cortical cells similar to those of the medulla. Rhizoids frequent, long, in hyaline, yellowish or brownish tufts from the bases of the underleaves. Line of leaf insertion oblique and curved in the upper part. Leaves distant to imbricate, ascendant-spreading, ovate from a broad base, the dorsal base curved, the ventral base straight or sometimes decurrent in less robust plants, narrowed to the shortly bifid apex, the segments short, triangular from a 2- to 4-celled base, ending in a 1- or 2-celled tip, the sinus U-shaped; cells of the upper part of the leaf hexagonal, regular, 26–39 × 26–39 μ, the walls uniformly thin, without trigones, the cuticle verruculose. Underleaves conspicuous, distant, broader than the stem, transversely elliptical in outline, deeply set on the stem, bifid and with a broad sinus, the teeth of segments usually broad, blunt, the lateral margins convex and with a second broad tooth or projection on the margin, additional short acute teeth sometimes present. Plants monoicous or dioicous (usually sterile). Male inflorescence catkin-like, the bracts and bracteoles scale-like, in up to 6 series, concave, imbricate. Female bracts and bracteoles in 3 or 4 series, small, scale-like, remaining at the mouth of the sac. Perigynium cylindrical, to 2 mm long, bearing rhizoids. Sporophyte not seen.

Pl. 70. Fig. 13, a–n.

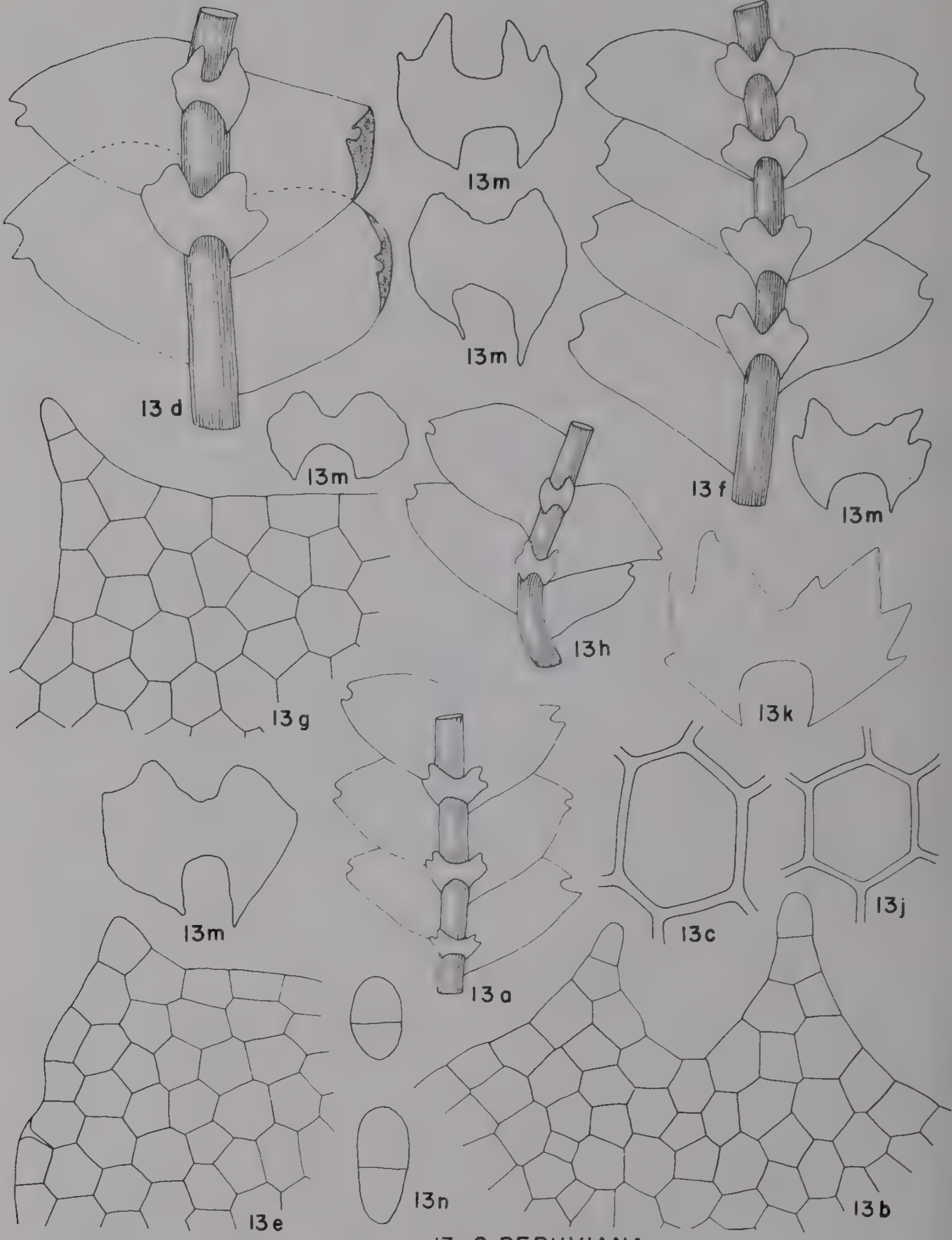
Habitat: In dense or lax mats on moist banks, shaded rocks, trees or decaying logs, or scattered among other bryophytes.

CUBA: Oriente: Sierra Maestra, summit of La Gato, *Imshaug 24842* (MSC); La Bayamesa, 1725 m, *Ekman* (UPS); Sierra Maestra, 1100 m, *Ekman 14370* p.p. (S-PA); s.l., *Wright, Hep. Cub. Wright.* as *C. miquelli* (NY), as *C. trichomanis* (Y).

JAMAICA: Blue Mountain Peak, *Orcutt 5320* (US), *Evans 227* (NY, Y), 7400 ft, *Webster 5510* p.p. (CAN); Cinchona, *Orcutt 5493A* (US), *Evans 369* (BM, NY, Y); Cinchona Plantation, 5000 ft, *Underwood 206* (NY, Y); Corn Puss Gap, *M. Farr 663* (IJ); summit of East Peak, *D. Powell & M. Farr 1035, 1045* (IJ); Fairy Glade above New Castle, *Barkley 22J297* (F); Morce's Gap, *Nichols 468* (BM, NY, Y), *Evans 39* (BM), *110, 115, 393* (Y), *526* (NY, Y); Newhaven Gap, *A. v. d. Porten 128* p.p., *140* p.p., *159* p.p., 5600 ft, *Harris 18a* (NY), 11015a (Y); John Crow Mountain, Crown Peak, 3500 ft, *Webster 5618, 5619* p.p. (CAN); John Crow Peak, *Evans 113, 119, 128* (BM, NY, Y), 5800–6000 ft, *Underwood 755* (NY, Y); Sir John Peak, *Evans 570* (Y); Portland Gap to Blue Mountain Peak, *Bengry 263* (IJ); St. Thomas, *Bengry 258* p.p. (IJ); Vinegar Hill, 5500 ft, *Harris 11015* (NY); s.l., 1000 m, *Rehder* (G-1802); s.l., *Wilde* (NY); without data, *no. 145* (NY).

DOMINICAN REPUBLIC: Las Amaceyes, 3000–3200 ft, *Imshaug & Wetmore 23281* (UPS).

PUERTO RICO: La Crucita, Sierra Caey, *Steere 4834* (Hb Fulford); prope Adjuntas, *Sintenis 58*, type of *K. portoricensis* (BM, G); s.l., *Schwanecke* (BM); Sierra de Naguabo, *N. L. Britton & Cowell 3101, 3102* (NY, Y); near Maricao, 430–800 m, *N. L. Britton, Cowell & Brown 4404* (NY, Y); El Yunque Peak, *Evans 154* (NY, Y); mountains between Guayama and Cayey, 700–900 m, *N. L. Britton, E. G. Britton & Brown 6585* (Y); Mt. Cerrote near Adjuntas, 900–1000 m, *N. L. Britton & Brown 5469* (NY, Y).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13. C. PERUVIANA

Plate 70

FIG. 13. *Calypogeia peruviana.* 13 a. Stem, ventral view, × 20. 13 b. Apex of a leaf, × 200. 13 c. Cell from the upper part of a leaf, × 500. 13 d. Stem, ventral view, × 20. 13 e. Portion of the upper part of a leaf, × 200. 13 f. Stem, ventral view, × 20. 13 g. Portion of the upper part of a leaf, × 200. 13 h. Stem, ventral view, × 20. 13 j. Cell from the upper part of a leaf, × 500. 13 k. Underleaf, × 50. 13 m. Underleaves, × 40. 13 n. Gemmae, × 200.

FIG. 13 a–c from the type of *C. peruviana*; 13 d–e from the type of *K. heterophylla*; 13 f–g from the type of *K. apiculata*; 13 h–j from the type of *C. muscicola*; 13 k from the type of *K. vincentina*; 13 m from various stems; and 13 n from Puerto Rican plants.

DOMINICA: Castle Bruce River, *Elliott 1627, 1676, 1699* (BM); Morne Caulisbon, 3700 ft, *Elliott 1867, 1882, 1883, 1922* (BM): Morne Diablotin, *Elliott 669c* p.p., *1988* p.p., *1991, 2117, 2147* p.p., *2148, 2195, 2204a* (BM); near Laudat, *Elliott 502a* (BM); Lagona Flats, *Elliott 2138* (BM); Morne Micotrin, *Elliott 7b, 1111, 1230d* p.p. (BM); near St. Andrews, 2500 ft, *Elliott 65, 873* (BM); Soufrière, 3000 ft, *Elliott 45, 1808* (BM); Morne Trois Pitons, *Elliott 2236, 2246a* p.p., *2251a* p.p., *2253, 2293, 2305* (BM); s.l., *Elliott 1904* (BM); s.l., *Elliott 1137*, type of *C. gigantea* (G).

GUADELOUPE: s.l., *Duss 167* (G); s.l., *Marie* (G-1822); s.l., *l'Herminier* (BM); s.l., *l'Herminier*, neotype of *C. biapiculata* (G-1801); s.l., *Duss 508*, lectotype of *C. subintegra* var. *dussiana* (G-12429); Soufrière, *Duss 1032* (NY); Hirondella, 600–673 m, *Duss 327* (NY).

ST. VINCENT: s.l., *Smith* (G-1830); s.l., Hb Hooker (NY); s.l., *C. W. Wright*, type of *K. vincentina* (G-1830); Richmond Peak, 2000–3000 ft, *Elliott 209, 214* (BM).

MARTINIQUE: s.l., *Duss 18, 26* (G); Deux-Choux, *Duss 26* (NY); Morne Paillasse near Deux-Choux, 680–900 m, *Duss 18a-26-167* (NY).

MEXICO: Mirador, *Liebmann 243* (C). Vera Cruz: below Atzalan, *Sharp 5594* p.p. (TENN.); Puebla: El Cerro de Cahuatepec, *Sharp 1397* p.p. (TENN.); Oaxaca: near Niltepec, 1800 ft, *Sharp 5763* (TENN.); San Luis Potosí: Cerro Prieto, 800 ft, *Sharp* (TENN.); Tamaulipas: e of Cd. Victoria, 7000 ft, *Purcell 5594* (Hb Fulford).

GUATEMALA: Quetzaltenango: Cerro de Sija, *Sharp 5049, 5059* p.p., 9500 ft, *Sharp 2219* (TENN.); Cobán, near Chicoyoneto, 4400 ft, *Türckheim 1* (G); San Marcos: slope of Tajumulco, 8000 ft, *Sharp 5501* p.p., *5503* (TENN.); El Progreso: between Calera and summit of Volcán Siglo, 2000–3300 m, *Steyermark 43057* (F); near summit of Volcán Santa Luisa, 2400–3333 m, *Steyermark 43513* (F). Alta Verapaz: Pansamala, 3800 ft, *Türckheim, Bryol. E. Levier* 12 (BM, G, NY, S-PA, Y). Baja Verapaz: near finca Bucaral, *Sharp 2765* p.p. (TENN.), Civija, 4100 ft, *Sharp 5200* p.p., *5219* (TENN.).

HONDURAS: El Achote, *Yuncker 6552, 6640* (DPU); slopes of Cerro de Nyerca, *Standley 759* (F); e of Ojos de Agua, *Standley 4814, 4835* p.p. (F); near El Zamorano, *Standley 4363* (F).

COSTA RICA: 8 km s of El Empalme, *Little 5643b, 8671d* (Hb Little); Santa Maria de Dota, *Standley 48694* (Hb Herzog, S-PA); Marias de La Palma, 1556 m, *Pittier 6018* (G); Los Angeles de San Ramón, *Brenes 15110, 15119* p.p. (F).

CENTRAL AMERICA: s.l., *Goebel* (G-1836).

TRINIDAD: Mt. Tucuche, *E. G. Britton, D. Coker & Rowland 1502* (Y); s.l., *Fendler* (NY).

COLOMBIA: Bogotá, *Weir* (NY), *Lindig* (BM); Andes Bogotá, *Apollinaire* (BM). Huila-Cauca: Páramo de las Papas, La Magdalena y Santiago, *H. Bischler 651, 681, 726* (COL). Meta: Cordillera La Macarena, Pico Renjifo, Caño Tiranas, 1700 m, *Schultes 11248* (FH). Putumayo: between Encino and Sibundoy, *Cuatrecasas 11744B* (US). s.l., *Weir* (NY); s.l., Hb Hampe (BM).

VENEZUELA: Caracas: Galipan, *Funck & Schlim 360* p.p., *368* (BM); Choroní Pass, *Fulford & Steyermark 1148a* (Hb Fulford); Bolívar: Cerro Venamo, Río Venamo, 900–1000 m, *Steyermark 92855* p.p.; 950–1150 m, *Steyermark 92445* p.p.; 1400–1575 m, *Steyermark 92575* p.p.; 1500 m, *Steyermark 92582* p.p. (VEN). Pico de El Avila, 2000 m, *Alston 5572, 5577A* (BM). Amazonas: Río Cunucunuma, 1200 m, near Camp II, *Maguire, Cowan & Wurdack 29910* (NY).

BRAZIL: Minas Gerais: Caldas, *Wildgren*, type of *C. abnormis* (S-PA, G-1843), Caldas, *Mosén* (G-1828, S-PA), *Regnell* (S-PA); Blumenau, *Ule 174* p.p. (G); Apiahy, *Puiggari 766* p.p., *766a* (G, UPS); Caraça, *Wainio 39* p.p. (BM, C, G-1818); Mte Pão de Assucar, *Ule 44*, type of *K. heterophylla* (BM, G-12421); São Paulo: Jard. Bot., *Fulford, Hatcher, Hell & Vital 638* (Hb Fulford); "Brasso Grande," Itapecerica, 1000 m, *Schiffner* (S-PA), *1905* (UPS); Rio Grande, 800 m, *Schiffner 880* (S-PA, UPS). Rio de Janeiro, *Douglas* (NY), Hb Müller (NY); Sta. Catarina: Iavagua, *Carl* (S-PA). s.l., *Burchell, Cat. Geogr. Pl. Brasilia trop. 3344* (NY).

BOLIVIA: Tablas, 1800 m, *Herzog 4587*, type of *C. subrotundata*. Cordillera de Santa Cruz, *Herzog 3892*, type of *C. muscicola* (G-12421). Ost. Cordillera, Cerro Amboro, 1200 m, *Herzog* (Y).

PERU: Inter Chupa et Yanacocha, 1000–2000 m, *d'Orbigny* (G-1840); s.l., ex Hb Nees *75* (type, PC); without data, 75–204 (PC). S. Gavan, without coll. (S-PA); s.l., *Lechler* (BM).

ECUADOR: Cayambe, *Jameson* (NY); Chimborazo, without coll. (NY).

14. Calypogeia oblata Herzog, Sv. Bot. Tidskr. **51**: 189. *f. 2.* 1957.

Plants of medium to large size, dark green to brownish, in mats or scattered among other bryophytes; stems prostrate, to 3 cm long, with leaves, to 2.5 mm wide, occasionally branched, the branches leafy, ventral intercalary, from the axils of the underleaves. Rhizoids scarce, long, hyaline, in a tuft from the base of an

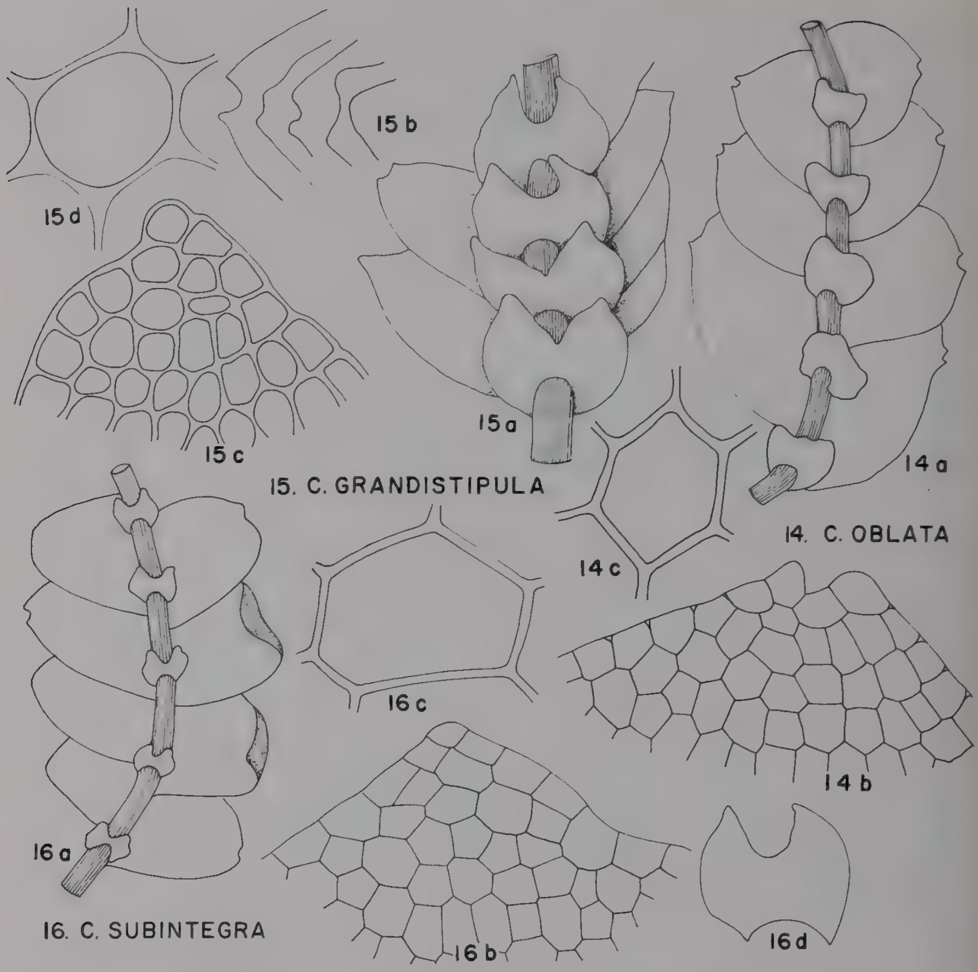

Plate 71

FIG. 14. *Calypogeia oblata*. 14 a. Stem, ventral view, × 15. 14 b. Upper part of a leaf, × 200. 14 c. Cell from the upper part of a leaf, × 500. Fig. 14 a, after Bischler, 1962, with permission of the Editor of Candollea; 14 b, c, from the type.

FIG. 15. *C. grandistipula*. 15 a. Stem, ventral view, × 20. 15 b. Apices of leaves, × 37. 15 c. Upper part of a leaf, × 200. 15 d. Cell from the upper part of a leaf, × 500. Drawn from the type.

FIG. 16. *C. subintegra*. 16 a. Stem, ventral view, × 30. 16 b. Upper part of a leaf, × 200. 16 c. Cell of the upper part of a leaf, × 500. 16 d. Underleaf, × 40. Fig. 16 a, after Bischler, 1962; 16 b–d, from the type.

underleaf. Line of leaf insertion oblique, the dorsal end curved over the stem. Leaves imbricate, more or less convex, broadly ovate to suborbicular, broadest at the base, to twice as broad as long, the apex broad-rounded, bidentate, the teeth very short, the dorsal and ventral margins strongly convex, the ventral base not decurrent; cells of the apical portion of the leaf hexagonal in outline, 26–40 × 26–40 μ, the walls uniformly thin, without trigones, the cuticle smooth. Underleaves distant, large, 2–3 times as broad as the stem, decurrent, orbicular with a broad, shallow, lunulate sinus above and convex or irregular lateral margins. Male and female inflorescences, perigynium and sporophyte not seen.

Pl. 71. Fig. 14, a–c.

Habitat: In depressed mats on damp soil at high elevations.

ECUADOR: Tungurahua: Cordillera de Los Llanganates near Los Torres, 3500 m, *Asplund H. 4* (type S-PA, Hb Herzog).
PERU: s.l., without coll. (S-PA).

15. **Calypogeia grandistipula** (Stephani) Stephani, Spec. Hep. **3**: 411. 1908.

Kantia grandistipula Stephani, Hedwigia **34**: 52. 1895.
Calypogeia puiggarii Stephani, Spec. Hep. **3**: 405. 1908.

Plants of medium size, in dense light green to yellowish mats on damp soil or with other bryophytes; stems rigid, compact, to 1.5 cm long, with leaves to 2 mm broad, irregularly pinnate; branches infrequent, leafy, short or long, ventral-intercalary from the axils of the underleaves; stem in transverse section of similar cells throughout. Rhizoids abundant, in large, light tan tufts from the bases of underleaves. Line of leaf insertion oblique. Leaves densely imbricate, erect spreading, ovate, 0.6–1.0 mm long, 0.4–0.6 mm wide at the middle, narrowing to the shortly bifid or occasionally blunt-acute apex, the dorsal base curved or semi-cordate, the ventral base scarcely decurrent; cells of the upper part of the leaf rounded, 26–40 × 26–35 μ, the walls thickened, the trigones small, conspicuous, with concave sides, the cuticle faintly verruculose. Underleaves imbricate, 3 or 4 times as broad as the stem, tending to be transversely elliptical, deeply set on the stem, bifid to one-half, the segments broadly triangular, sometimes with the suggestion of a broad tooth on the outer wall, the sinus broad, U- or V-shaped. Male and female inflorescences and sporophyte not seen.

Pl. 71. Fig. 15, a–d.

Habitat: On damp soil and decaying wood in forests.

BRAZIL: Sitio, *Wainio 66* (type G); Apiahy, *Puiggari*, type of *C. puiggarii* (G-1829).

16. **Calypogeia subintegra** (Gottsche, Lindenberg & Nees) Bischler, Candollea **18**: 75. *f. 23.* 1962.

Calypogeia peruviana var. *subintegra* Gottsche, Lindenberg & Nees, Syn. Hep. 712. 1847.

Plants of medium size, light green to yellow-green becoming yellow-brown, in mats or among other bryophytes; stems creeping, rarely stout, to 5 cm long, with leaves to 2 mm broad, frequently branched; branches leafy or small-leaved or flagelliform, or short-sexual, ventral-intercalary from the axils of the underleaves; stem in transverse section of thin-walled cells, the cells of the cortical layer smaller than those of the medulla except in the area of leaf-attachment. Rhizoids numerous, hyaline, in tufts from the bases of underleaves. Line of leaf insertion curved in the upper part. Leaves imbricate, broadly ovate to oblong, 0.6–1.6 mm long, 0.4–1.6 mm wide below, plane, the dorsal base curved, the ventral base not decurrent, the apex broad or narrowed, entire or an occasional leaf shortly bidentate, the teeth short; cells mostly hexagonal, in the upper part of the leaf 30–40 × 25–35 μ, thin-walled, without trigones, the cuticle essentially smooth. Underleaves bifid to one-half their length, broadly truncate-ovate to orbicular in outline, the segments broad-triangular, only rarely with a blunt tooth on the outer margin, the base rounded, deep-set on the stem. Male and female inflorescences and sporophyte not seen.[4]

Pl. 71. Fig. 16, a–d.

Habitat: On soil.

MEXICO: s.l., *Liebmann* (S-PA); Huatusco, *Liebmann 375* p.p. (type C); Mirador, *Liebmann*, ex Hb Hampe (BM). Chiapas: Mapastepec, sierra, 6000 ft, *Sharp 4564* p.p. (TENN); Puebla: w of Huauchinango, 5150–5400 ft, *Sharp 860, 872, 883, 921* (TENN); below Huauchinango, 4200 ft, *Sharp 3077* (TENN); near Villa Juarez, 3800 ft, *Sharp 3158* (TENN); near Zacapoaxtla, 5000–5400 ft, *Sharp 4212, 4231* (TENN). Vera Cruz: near Orizaba, Cerro de San Cristóbal, 5000 ft, *Sharp 5539* (TENN).

17. Calypogeia andicola Bischler, Candollea **18**: 79. *f. 25.* 1962.

Calypogeia colombica S. Arnell, in Hb.

Plants of medium size, turgid, creeping, dark green, in mats or scattered among other bryophytes; stems to 5 cm long, with leaves, 1.5–2 mm wide, rarely branched, the branches leafy, ventral-intercalary from the axils of the underleaves. Rhizoids frequent, long, in tufts from the bases of the underleaves. Line of leaf insertion oblique, curved over the stem at the upper end. Leaves imbricate, oblong-ovate, the apex broad, obtuse or mucronate, to 1.0 mm long, 0.7 mm wide, the dorsal base curved, the ventral base not decurrent; cells of the upper part of the leaf hexagonal, 30–42 × 30–42 μ, the walls thin, without trigones, the cuticle smooth. Underleaves scarcely broader than the stem, small, subquadrate to transversely orbicular, the line of insertion curved, decurrent, bifid to one-half, the segments triangular, without lateral teeth, the sinus broad, U-shaped, the cells longer than broad, thin-walled. Male and female inflorescences and sporophyte not seen.

Pl. 72. Fig. 17, a–e.

Habitat: On damp soil and rotten wood in montane forests.

COLOMBIA: Bogotá, *Weir*; Bogotá: Valle de La Playa, 4100 m, *Grubb & Guymer*, as *C. colombica* (UPS). Cauca: Macizo Colombiano, Páramo de Las Papas, 3200–3500 m, *Bischler 738* (COL). Cundinamarca: Camino real Bojocá-Tena, 800–2300 m, *Bischler 1149B* (G); Páramo de Choachí, 3000 m, *Bischler 2201* (type G-12418). Tolima: du Cote d'Ibagué, 3200 m, *Bischler 528, 530* (G).

ECUADOR: Quito, *Jameson* (G-1805, PC).

BOLIVIA: Gran Poder, 9500 ft, *W. Brooke 6453A* (BM).

18. Calypogeia uncinulatula Herzog, Hedwigia **67**: 250. 1927.

Plants of medium size, light green to yellow-green, in depressed mats or among other bryophytes; stems to 5 cm long, with leaves to 2.5 mm broad, sparingly irregularly branched; branches leafy, ventral-intercalary from the axils of the underleaves. Rhizoids in brownish tufts from the bases of underleaves. Leaf insertion oblique. Leaves not bordered, approximate, widely spreading, ascendant on the branches, ovate, the apex narrowed, bifid, the teeth triangular from a 2- to 4-celled base, ending in a 2-celled tip, the dorsal margin scarcely curved at the base, the ventral margin scarcely decurrent; cells of the upper part of the leaf small, hexagonal, 26–34 × 26 μ, the walls thin, the trigones small, the cuticle essentially smooth. Underleaves distant, scarcely decurrent, small, as broad as the stem, bifid

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[4] The species suggests small plants of *C. peruviana* in both the cellular detail of the leaves and the deep set insertion of the underleaves. It differs from that species in having most leaf-apices undivided and the bifid underleaves without a conspicuous lateral tooth or hump on one or both sides.

to the middle, the lateral margins curved, the segments triangular, rarely with one supplementary tooth. Male and female inflorescences and sporophyte not seen.

Pl. 72. Fig. 18, a–e.

Habitat: In mats on damp soil.

GUATEMALA: Quezaltenango: Volcán Zunil, *Standley 85970* (F), slope of Volcán Santa María, 1300–1500 m, *Steyermark 33659* (F), Chiquival, 7700 ft, *Sharp 2082* (TENN). Baja Verapaz: Civija, 4000 ft, *Sharp 5183* (TENN). El Progreso: near Calera, Volcán Siglo, 2000–3300 m, *Steyermark 43057* (F). San Marcos: El Porvenir, slope of Tajumulco, 8000 ft, *Sharp 5501* (TENN); Barranco, Eminencia, 2500–2700 m, *Standley 86462* (F).

BRAZIL: São Paulo: Ilha da Queimada Grande, *Gehrt 22* (type Hb Herzog, S-PA). Minas Gerais: Caldas, *Mosén* (S-PA).

PERU: St. Gavan, without coll. (S-PA); Junin, Villa Amorelle, 1000 m, *Kunkel 378* (S-PA).

BOLIVIA: Unduavi, 10,200 ft, *W. Brooke 6893A* (BM).

19. Calypogeia tenax (Spruce) Stephani, Spec. Hep. **3**: 396. 1908.

Kantia tenax Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 416. 1885.

Plants large, in yellow- to olive-green mats; stems creeping, to 7 cm long, with leaves, to 3 mm or more broad, irregularly pinnate; branches frequent, long, leafy, ventral-intercalary from the axils of the underleaves, sometimes small-leaved, occasionally branched; stem in transverse section of similar cells throughout. Rhizoids occasional, hyaline or yellowish, in a tuft from the base of an underleaf. Line of leaf insertion oblique, the dorsal end scarcely curved. Leaves imbricate, widely spreading, tending to be slightly ascendant, subrectangular, 1.1 × 0.84 mm, the dorsal base slightly curved, the apex broad, truncate-rounded, the ventral base scarcely decurrent; cells of the margin of the upper part of the leaf variable, 30–52 × 20 μ, often broader than high and forming an indistinct border; cells of the upper part of the leaf 30–50 × 30 μ, hexagonal to elongate, the walls uniformly thin, without trigones, the cuticle smooth. Underleaves longer than broad, a little broader than the stem, bifid to below the middle, the segments narrowly ovate-acute, the cells elongate. Female bracts and bracteoles in 3 or 4 series, the intermediate series to 0.96 mm long, pale, the cells elongate. Male inflorescence and sporophyte not seen.

Pl. 72. Fig. 19, a–d.

Habitat: On damp soil, rotten wood, and rootlets of palm.

COLOMBIA: Amazonas-Vaupés: Río Piraparana, Soratama, 250 m, *Schultes & Cabrera 13833* (FH); Río Piraparana, headwaters of Caño Teemeeñe, *Schultes & Cabrera 17406* (FH).

VENEZUELA: Aragua: Choroní Pass, 1595 m, *Fulford & Steyermark 1145* p.p. (Hb Fulford).

BRAZIL: San Carlos et flumen Uaupés, *Spruce*, *Hep. Spruc.* (lectotype MANCH, isotypes BM, G, NY, Y).

20. Calypogeia rhombifolia (Spruce) Stephani, Spec. Hep. **3**: 399. 1908.

Kantia rhombifolia Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 413. 1885.
Calypogeia subrectifolia Stephani, Spec. Hep. **3**: 402. 1908.

Plants of medium to large size, pale yellowish to green becoming tinged with brown, in mats or scattered among other bryophytes; stems prostrate, to 6 cm long, with leaves 1.5–2 mm wide, irregularly pinnate; the branches often long, leafy, ventral-intercalary from the axils of the underleaves; stem in transverse section of a variable cortical layer, those cells under the leaf insertion very large. Rhizoids in light yellow-brown tufts from the bases of underleaves. Line of leaf insertion oblique, nearly longitudinal. Leaves approximate to subimbricate, inconspicuously

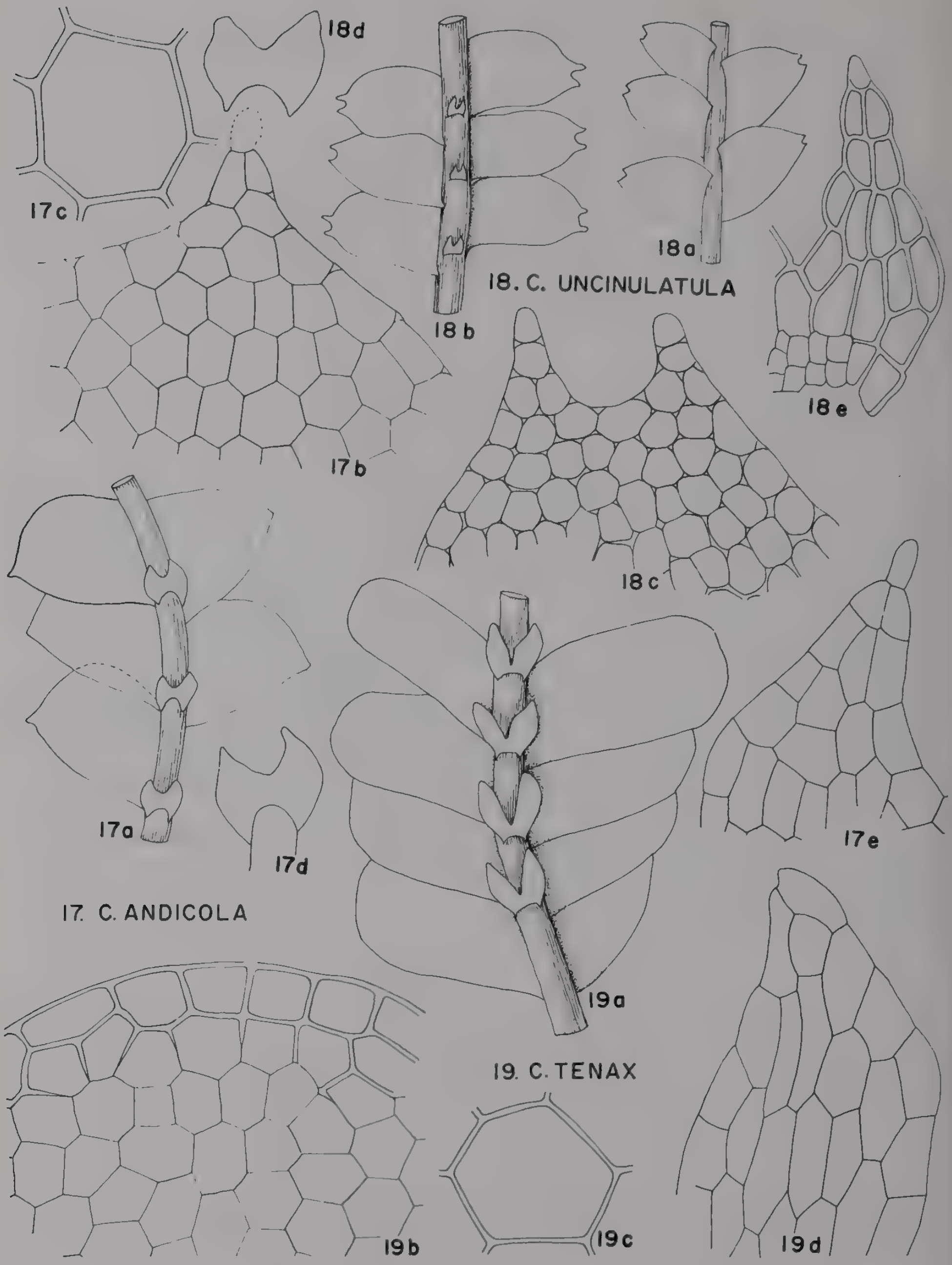
18d
17c
18a
18. C. UNCINULATULA
18b
18e
17b
18c
17a
17d
17e
17. C. ANDICOLA
19a
19. C. TENAX
19b
19c
19d

Plate 72

FIG. 17. *Calypogeia andicola.* 17 a. Stem, ventral view, × 20. 17 b. Leaf apex, × 200. 17 c. A cell from the upper portion of a leaf, × 500. 17 d. Underleaf on a stem, × 50. 17 e. Portion of an underleaf, × 200. Drawn from the type.

FIG. 18. *C. uncinulatula.* 18 a. Stem, dorsal view, × 15. 18 b. Stem, ventral view, × 20. 18 c. Upper part of a leaf, × 200. 18 d. Underleaf, × 40. 18 e. Portion of an underleaf, × 200. Drawn from the type.

bordered in the lower part, plane, widely spreading, asymmetric, suborbicular to subquadrate, rarely broadly ovate from a broad base, the dorsal side short, nearly straight with the base slightly curved, the ventral side strongly convex, scarcely decurrent, the tip acute or shortly bifid, the teeth of 1–3 cells; cells of the dorsal margin of the lower two-thirds of the leaf, rectangular and similar to the adjacent cells, 35–50 × 25 μ, the marginal cells of the upper third 20–35 × 20 μ with projecting cell angles; cells of the upper lamina mostly 26–39 × 26–39 μ, the walls thin, the trigones very small, the cuticle faintly verruculose. Underleaves distant, small, truncate-ovate, bifid to one-half or more, the segments triangular, the line of insertion transverse to slightly curved. Plants dioicous. Male inflorescence short, catkin-like, the bracts and bracteoles concave, scale-like. Female inflorescence and sporophyte not seen.

Pl. 73. Fig. 20, a–e.

Habitat: On damp soil, rocks, and tree trunks in forests.

DOMINICA: Castle Bruce River, *Elliott 1652, 1713* (BM); Grand Soufrière, *Elliott 1811B* (BM); Morne Diablotin, 3000 ft, *Elliott 1044, 2103* p.p., *2104* p.p. (BM); Lagona Flats, *Elliott 2126* (BM); Morne Trois Pitons, *Elliott 743* (BM).

COLOMBIA: Antioquia, near to Pto Valdivia, 800 m, *Bischler 7, 8, 12* (COL). Cordillera La Macarena, Pico Renjifo, 1700 m, *Schultes 11228* (FH).

VENEZUELA: Amazonas: Río Orinoco, Río Cunucunuma, 'Camp II,' 1200 m, *Maguire, Cowan & Wurdack 29906* (NY). Bolívar: Río Venamo, 1200–1275 m, *Steyermark 92751, 92752* (VEN).

ECUADOR: Andes Quitenses: flumen Bombonasa, *Spruce, Hep. Spruc.* (type MANCH-Kk 1708, isotypes BM, NY, Y).

PERU: Tatanera, without coll. (S-PA).

21. **Calypogeia rhombifolia** var. **colombica** Bischler, Candollea **18**: 104. *f. 34.* 1962.

The variety is similar to the species but differs in that it is slightly larger and the cells of the leaf are somewhat different. The cells of the dorsal margin in the lower two-thirds of the leaf are long-rectangular, 50–117 × 13–20 μ, as are those of the ventral margin and the interior. In contrast, in the species the cells of the dorsal margin are only 35–50 × 25 μ. The underleaves are also somewhat larger.

Pl. 73. Fig. 21, a–f.

Habitat: On damp soil at altitudes of 500–600 m.

COLOMBIA: Valle: a 43 km de Buenaventura, de la route Cali-Buenaventura, 500 m, *Bischler 477* (type G), same locality, *Bischler 475* (G-12428), same locality, 600 m, *Bischler 443B* (G-12427).

22. **Calypogeia densifolia** (Stephani) Stephani, Spec. Hep. **3**: 408. 1908.

Kantia densifolia Stephani, Hedwigia **34**: 52. 1895.
Calypogeia lechleri var. *densifolia* (Stephani) Bischler, Candollea **18**: 101. *f. 32.* 1962.

Plants of medium size, olive- to dark green, becoming pigmented with brown, in mats or among other bryophytes; stems prostrate, to 1 cm or more long, with leaves, 1.0–1.5 mm wide, irregularly pinnate; branches frequent, leafy or small-leaved, ventral-intercalary from the axils of the underleaves. Rhizoids occasional, in brown tufts from the bases of underleaves. Line of leaf insertion oblique, nearly

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FIG. 19. *C. tenax.* 19 a. Stem, ventral view, × 37. 19 b. Portion of the upper margin of a leaf, × 200. 19 c. Cell from the upper portion of a leaf, × 500. 19 d. Segment of an underleaf, × 200. Drawn from the type.

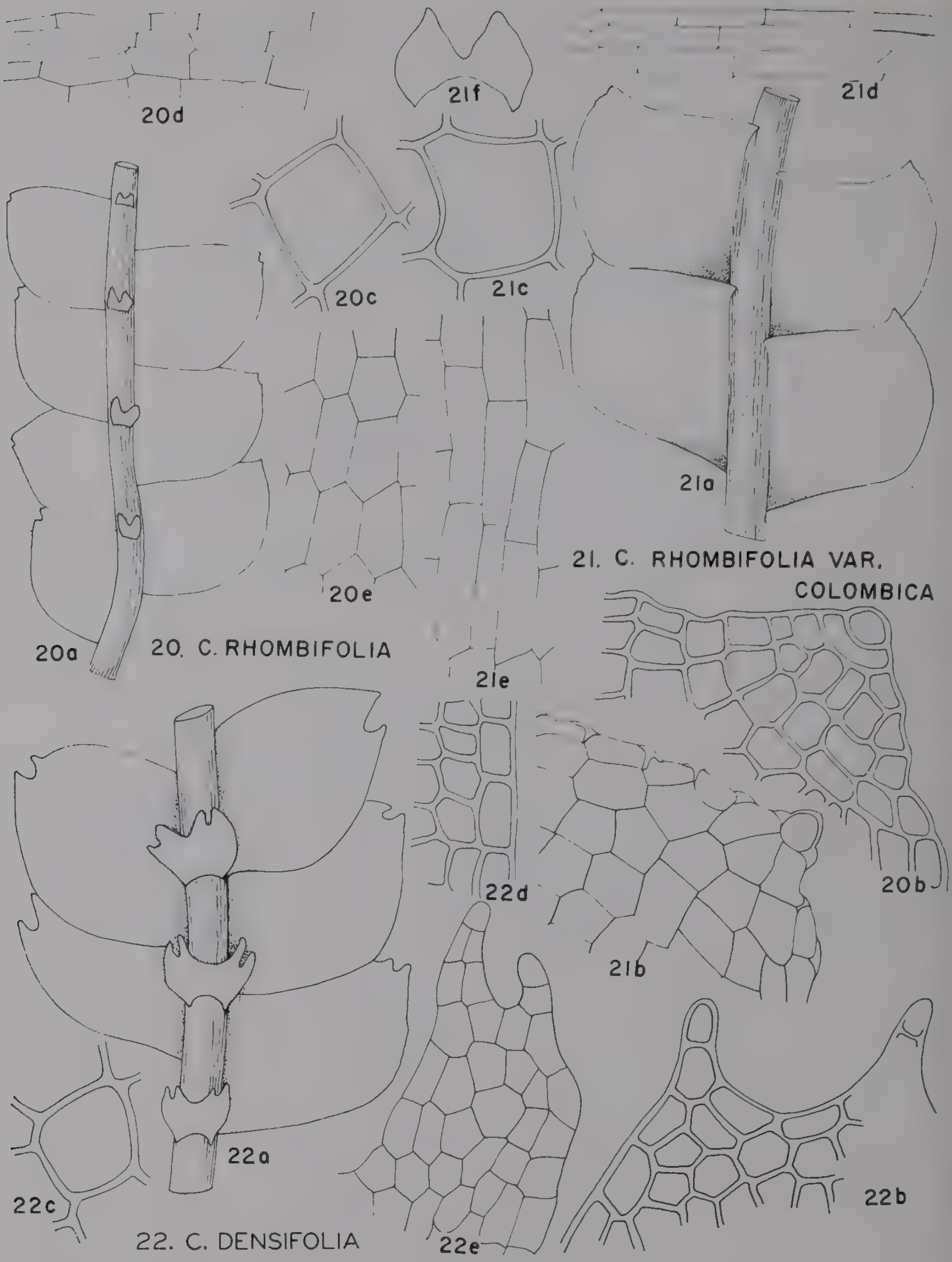
20d
21f
21d
20c
21c
20e
21a
21e
21. C. RHOMBIFOLIA VAR. COLOMBICA
20a
20. C. RHOMBIFOLIA
20b
22d
21b
22a
22c
22. C. DENSIFOLIA
22e
22b

Plate 73

FIG. 20. *Calypogeia rhombifolia*. 20 a. Stem, ventral view, × 20. 20 b. Apex of a leaf, × 200. 20 c. Cell of the upper part of a leaf, × 500. 20 d. Cells of the dorsal border of a leaf, × 200. 20 e. Cells from the middle of the leaf, × 200. Drawn from the type.

FIG. 21. *C. rhombifolia* var. *colombica*. 21 a. Stem, dorsal view, × 20. 21 b. Apex of a leaf, × 200. 21 c. Cell from the upper part of a leaf, × 500. 21 d. Cells of the dorsal border of a leaf, × 200. 21 e. Cells from the middle of the leaf, × 200. 21 f. Underleaf, × 50. Drawn from the type.

longitudinal. Leaves imbricate, ascendant, conspicuously bordered below, weakly so above, asymmetric with the dorsal margin shorter, longer than broad, 0.7–0.9 × 0.6–0.7 mm, the ventral side strongly convex above, the apex bifid, the teeth triangular from a 2- to 4-celled base, acute; cells of the ventral border near the base 44–55 × 18 μ, the end walls truncate, rarely oblique, the cells of the dorsal border and upper margin 24–39 × 20 μ, the cells of the upper lamina 26–30 × 20 μ, the walls thin, often brownish, the trigones small, distinct, the cuticle finely punctate. Underleaves broader than the stem and broader than long, bisbifid to the middle, 10–12 cells broad at the line of attachment, the lamina large, the lateral margins convex, bordered by longer cells, the segments uniseriate or narrowly triangular. Male and female inflorescences and sporophyte not seen.

Pl. 73. Fig. 22, a–e.

Habitat: On damp soil and trunks of palm at low altitudes.

COLOMBIA: Amazonas: Río Miritiparaná, Caño Guacayá, 700 ft, *Schultes & Cabrera 15793* (FH).

BRAZIL: s.l., *Ule 166* (type BM, G-12424).

23. **Calypogeia lechleri** (Stephani) Stephani, Spec. Hep. **3**: 412. 1908.

Kantia lechleri Stephani, Hedwigia **34**: 53. 1895.
Calypogeia contigua Stephani, in Hb.

Plants of medium size, yellow- to olive-green becoming deeply pigmented with brown, in depressed mats or among other bryophytes; stems to 2.5 cm or more long, with leaves 1.5–2.3 mm broad, the stems often asymmetric or becoming small-leaved for a distance, irregularly pinnate; branches leafy or rarely flagelliform, short or long, ventral-intercalary from the axils of the underleaves; stem in transverse section with a cortical layer of thin-walled cells slightly larger than those of the medulla. Rhizoids in hyaline, yellowish, or brownish tufts from the bases of the underleaves. Line of leaf insertion longitudinal but curved at the upper end. Leaves distant to subimbricate, conspicuously bordered except near the apex, asymmetric, typically subquadrate, more rarely broadly ovate, 0.6–0.8 mm long, 0.5–0.7 mm broad at the middle, the dorsal side short, the apex shortly bifid, the teeth 1- to 3-celled, the ventral side strongly convex above, the base decurrent (especially in small-leaved, etiolated stems); leaf border of the lower two-thirds of the leaf, of elongate cells, 78–104 × 15–20 μ, with short oblique ends, the border of the upper part of the leaf of cells 26–40 × 26 μ, forming a coarsely crenulate margin from the projecting cell angles; cells of the upper lamina 26–40 × 26–34 μ, the walls thin, the trigones small or absent, the cuticle verruculose. Underleaves small, conspicuous, distant, scarcely broader than the stem, bisbifid, the base 6–12 cells wide, the larger segments 2–4 cells long, 1 or 2 cells wide. Male and female inflorescences and sporophyte not seen.

Pl. 74. Fig. 23, a–e.

Habitat: On soil and moist rocks in montane forests.

COLOMBIA: Amazonas: Río Apaporis, *Schultes & Cabrera 13202* (FH). Santander del Norte: Catatumbo, cerca de Las Mercedes, 1000 m, *Bischler 2290*, *2591B*, *2669C* (G).

VENEZUELA: Amazonas: Río Orinoco, 'Camp II,' 1200 m, *Maguire*, *Cowan & Wurdack 29925* p.p. (NY). Bolívar: Chimantá Massif, Abácapá-tepuí, 1210–1600 m, *Steyermark 75085*

FIG. 22. *C. densifolia*. 22 a. Stem, ventral view, × 50. 22 b. Upper portion of a leaf, × 200. 22 c. Cell from the upper part of a leaf, × 500. 22 d. Cells of the dorsal border of a leaf, × 200. 22 e. Portion of an underleaf, × 200. Drawn from the type.

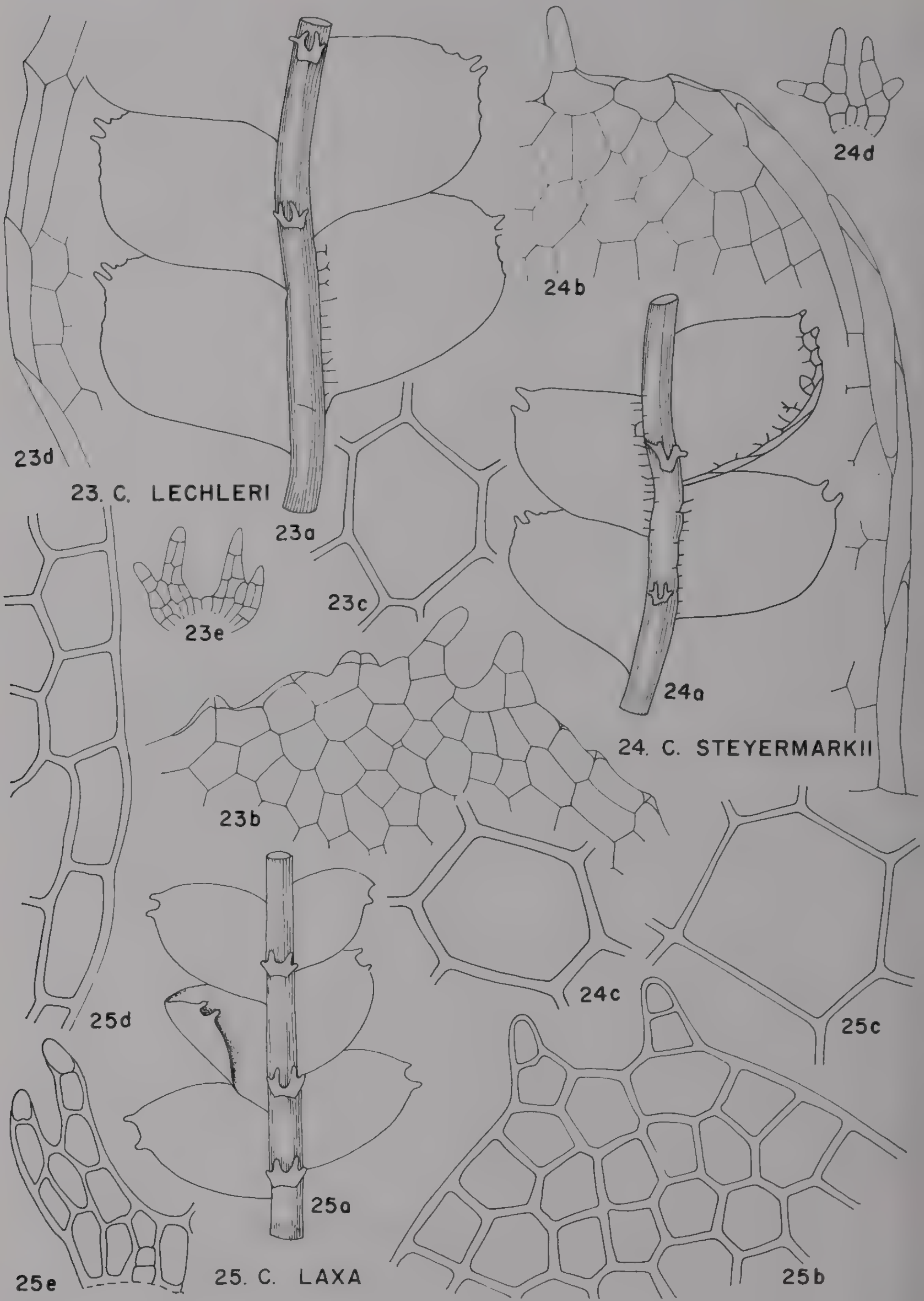
24d
24b
23d
23. C. LECHLERI
23a
23e
23c
24a
24. C. STEYERMARKII
23b
24c
25c
25d
25e
25. C. LAXA
25a
25b

Plate 74

FIG. 23. *Calypogeia lechleri.* 23 a. Stem, ventral view, × 25. 23 b. Apex of a leaf, × 200. 23 c. Cell from the upper part of a leaf, × 500. 23 d. Dorsal basal margin of a leaf, × 200. 23e. Underleaf, × 70. Drawn from the type.

FIG. 24. *C. steyermarkii.* 24 a. Stem, ventral view, × 50. 24 b. Portion of the apex and

(NY); Sierra Ichún, 625–725 m, *Steyermark 90210* (VEN). Sucre: Peninsula de Paria, 1060 m, *Steyermark 94844* p.p., *94851* p.p., *94853* p.p. (VEN).

BRAZIL: Pão de Assucar, *Ule 32* (G); São Paulo: Santos, *Mosén* (G-1817, S-PA, UPS).

PERU: St. Gavan, *Lechler* (lectotype G-1806, NY); without data (MANCH); Yungas, 6000 m, *Rusby 5047* p.p. (NY); Caroico, 1300 m, *Buchtien* (S-PA).

24. Calypogeia steyermarkii Fulford, sp. nov.

Plantae graciles, ad 3 cm longas, olivaceae; folia subquadrata, asymmetrica, latere dorsali brevi, breviter bifida, margine e cellulis longis angustis constato, 130–230 × 15 μ, extremitatibus longe obliquis superpositisque. Amphigastria minuta, bisbifida. Inflorescentiae non visae.

Plants long, slender, prostrate, brownish-green, in mats or scattered among other bryophytes; stems to 3 cm or more long, with leaves, 1.0–1.4 mm broad, rarely branched; branches leafy, ventral-intercalary from the axils of underleaves. Rhizoids dark brown, a few from the base of an underleaf. Line of leaf insertion longitudinal but curving across one stem cell at the upper end. Leaves approximate, subquadrate, conspicuously bordered, asymmetric with the dorsal side shorter, 0.54–0.6 mm long, 0.48–0.6 mm wide at the middle, the apex shortly bifid, the uniseriate teeth 2- to 4-celled; border, except near the apex, of narrow elongate cells 130–230 × 15 μ, the ends long-pointed and long-obliquely overlapping, the border near the apex of cells 39–52 × 22–30 μ, the end walls protruding; cells of the upper lamina 30–40 × 26–33 μ, thin-walled, without trigones, the cuticle essentially smooth. Underleaves tiny, bisbifid, the base 4–6 cells across, the 'long' segments 2 or 3 cells long from the base, the 'arms' of 1 or 2 cells. Male and female inflorescences and sporophyte not seen.

Pl. 74. Fig. 24, a–d.

Habitat: On a limestone bluff.

VENEZUELA: Anzoatequi: Cerro Peonía, 1000–1450 m, *Steyermark 61406* (type VEN).

25. Calypogeia laxa Gottsche & Lindenberg in G. L. & N. Syn. Hep. 713. 1847.

Kantia laxa (Gottsche & Lindenberg) Trevisan, Mem. Ist. Lomb. III. **4**: 425. 1877.
Kantia subtropica Stephani, Hedwigia **34**: 54. 1895.
Calypogeia subtropica (Stephani) Stephani, Spec. Hep. **3**: 410. 1908.

Plants of medium to large size, light green, in mats or creeping among other bryophytes; stems prostrate, to 5 cm or more long, with leaves, to 3 mm wide, rarely branched; branches leafy, often asymmetric, or flagelliform, ventral-intercalary from the axils of the underleaves. Rhizoids frequent, long, in hyaline or yellowish-brown tufts from the lower part of the underleaf. Leaves subimbricate, widely spreading to ascendant, bordered, broadly to narrowly ovate, the apex broad, rounded, bidentate, the teeth erect to divergent, mostly uniseriate, 1 or 2 cells long, the sinus broad U-shaped, the dorsal base scarcely curved, the ventral base not decurrent; leaf border distinct, of rectangular cells below and subquadrate cells above; cells of the upper part of the leaf mostly hexagonal, 39–50 × 30–40 μ, the walls uniformly thickened, the cuticle essentially smooth. Underleaves bisbifid,

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the dorsal margin of a leaf, × 200. 24 c. Cell of the upper part of a leaf, × 500. 24 d. Underleaf, × 160. Drawn from the type.

FIG. 25. *C. laxa*. 25 a. Stem, ventral view, × 20. 25 b. Upper part of a leaf, × 200. 25 c. Cell from the upper part of a leaf, ×500. 25 d. Cells of the dorsal margin of a leaf, × 200. 25 e. Part of an underleaf, × 50. Drawn from the type.

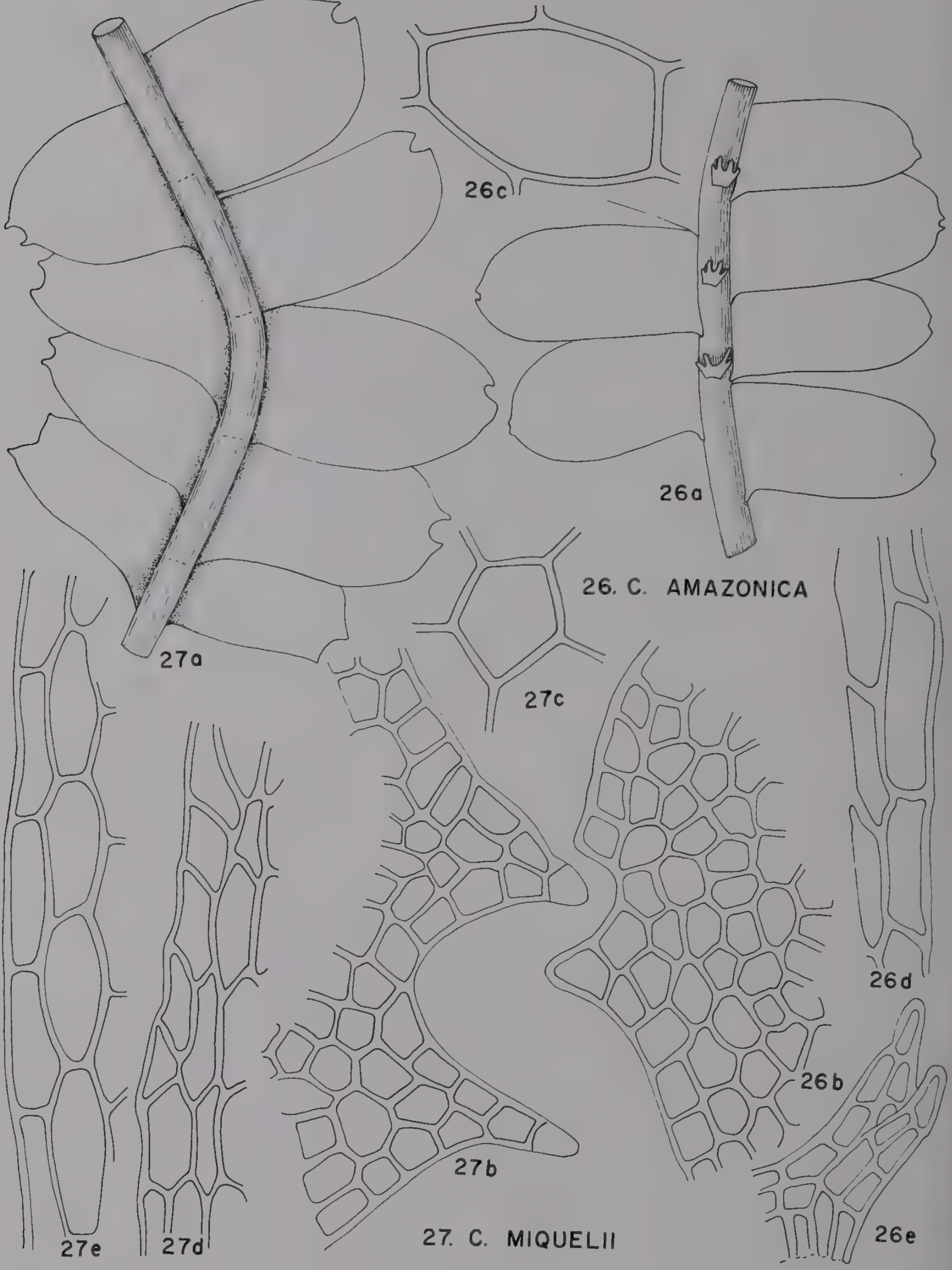
26c
26a
26. C. AMAZONICA
27a
27c
26d
26b
26e
27b
27e
27d
27. C. MIQUELII

Plate 75

FIG. 26. *Calypogeia amazonica.* 26 a. Stem, ventral view, × 20. 26 b. Apex of a leaf, × 200. 26 c. Cell from the upper part of a leaf, × 500. 26 d. Cells of the dorsal margin of a leaf, × 200. 26 e. Part of an underleaf, × 160. Drawn from the type.

FIG. 27. *C. miquelii.* 27 a. Stem, ventral view, × 20. 27 b. Apex of a leaf, × 200. 27 c. Cell of the upper part of a leaf, × 500. 27 d. Cells of the dorsal margin of a leaf, × 200 27 e. Cells of the ventral margin of a leaf, × 200. Drawn from the type.

distant, small, scarcely wider than the stem, the lamina usually 2 rows of cells high, the middle sinus lunulate, the segments short. Plants dioicous. Male inflorescence short, catkin-like, the bracts small, concave. Female inflorescence with 2 or 3 series of scale-like bracts and bracteoles. Perigynium 2–3 mm long, bearing numerous rhizoids. Spores yellow.

Pl. 74. Fig. 25, a–e.

Habitat: In loose or dense mats on soil, banks and rocks in wooded areas.

CUBA: Pinar del Río: Sierra de Cobre, *E. G. Britton 7299* (NY, Y); Santa Clara, Trinidad Mountain, Aquaeata, *E. G. Britton 5416* (NY, Y); Retiro, *Wright* (Y); mountain of Raugel, *Wright* (Y); Isle of Pines: near Júcaro, *Britton, Britton & Wilson 14643* (NY, Y).

JAMAICA: Vinegar Hill, *Evans* (Y).

PUERTO RICO: Fajardo, *Heller & Heller 997a* (NY, Y); La Juanita near Las Marias, *E. G. Britton 3981* (NY, Y); Monte Cerrote near Adjuntas, 900–1050 m, *Britton & Brown 5469* (Y); near Mayaguez, *E. G. Britton & D. Marble 531* (NY, Y), Luquillo Mountains: El Yunque, *Evans 114* (NY, Y); Pico del Oeste, *Howard 1* p.p. (Hb Fulford).

HAITI: Petet Boryne to Mt. Casse, 1700 ft, *Nash 499* (NY, Y).

DOMINICA: Roseau Lake, 2500 ft, *Elliott 1210* (BM); St. Aroment, *Elliott 1256* (BM); Soufrière Hills, 2000–3000 ft, *Elliott 1820* (BM); Morne Caulisbon, 3700 ft, *Elliott 1887, 1890* (BM).

MEXICO: Huatusco, *Liebmann 375* p.p. (lectotype C); Chiapas: Mt. Las Casas, *Sharp 3206* p.p. (TENN).

GUATEMALA: Alta Verapaz: n of Cobán, *Sharp 2972* (TENN). Baja Verapaz: 4100 ft, *Sharp 5178* p.p., *5242* (TENN). Izabal, *Jones & Facey 3351* (NY).

COLOMBIA: Andes Bogotá, *Weir* (NY); Bogotá, *Weir* (NY). Antioquia: Yarumal, 2300 m, *Bischler 77* (COL).

VENEZUELA: Aragua: Choroní Pass above Maracay, *Fulford & Steyermark 1154* (Hb Fulford); Parc Nat. H. Pittier, Rancho Grande, 1100 m, *Steyermark, Lourteig & Agostini 95839* p.p. (VEN). Mérida: s w of Canaguá, 1950–2135 m, *Steyermark 56431* (F); along Río Onia near Bolero, 545–915 m, *Steyermark 46721, 56721* (F); silva of Volcán Guayabitos, 7400 m, *Vareschi 7604* (VEN); El Avila, between Flores and Trifon, 1700 m, *Fulford & Steyermark 1037* p.p., *1045* (Hb Fulford); sobre Sierra, 1400 m, *Vareschi* (VEN). Sucre: Peninsula de Paria, 160 m, *Steyermark 94853* p.p. (VEN).

BRAZIL: Caldas, *Regnell 53, 54* (S-PA); Rio de Janeiro, *Ule* [1889] (G-12423), s.l., *Ule 104*, type of *K. subtropica* (G-12422, BM). São Paulo, *Schiffner 2060* p.p., *4399* p.p. (S-PA, UPS, W); São Paulo, Jard. Bot., *Fulford, Hatcher, Hell & Vital 646* p.p. (Hb Fulford).

26. Calypogeia amazonica (Spruce) Stephani, Spec. Hep. **3**: 412. 1908.

Kantia amazonica Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 415. 1885.

Plants of medium to large size, yellow-green becoming pigmented with brown, prostrate, in mats or among other bryophytes; stems to 5 cm long, with leaves to 3 mm wide, occasionally branched, the branches leafy, short, ventral-intercalary from the axils of underleaves. Rhizoids abundant, colorless, long, in large tufts from the bases of most underleaves. Line of leaf insertion longitudinal except at the upper end. Leaves approximate to subimbricate, bordered in the lower half, large, symmetric, oblong, to 1.78 × 0.72 mm, the margins parallel, the apex broad, very shortly bifid or more rarely acute, the teeth mostly 1-celled; cells of the apical portion mostly longer than broad, 50–65 × 39 μ, cells of the dorsal and ventral basal margins 80–100 × 26 μ, the walls uniformly thickened, without trigones. Underleaves as broad as the stem, cuneate, bisbifid, the sinus very broad, the segments rather short. Female bracts in several series, short, scale-like, bifid. Male inflorescence and sporophyte not seen.

Pl. 75. Fig. 26, a–e.

Habitat: On damp soil, sand, or more rarely on decaying wood or bark.

TRINIDAD: Mt. Tucuche, *E. G. Britton, Coker & Roland 1802* (NY).

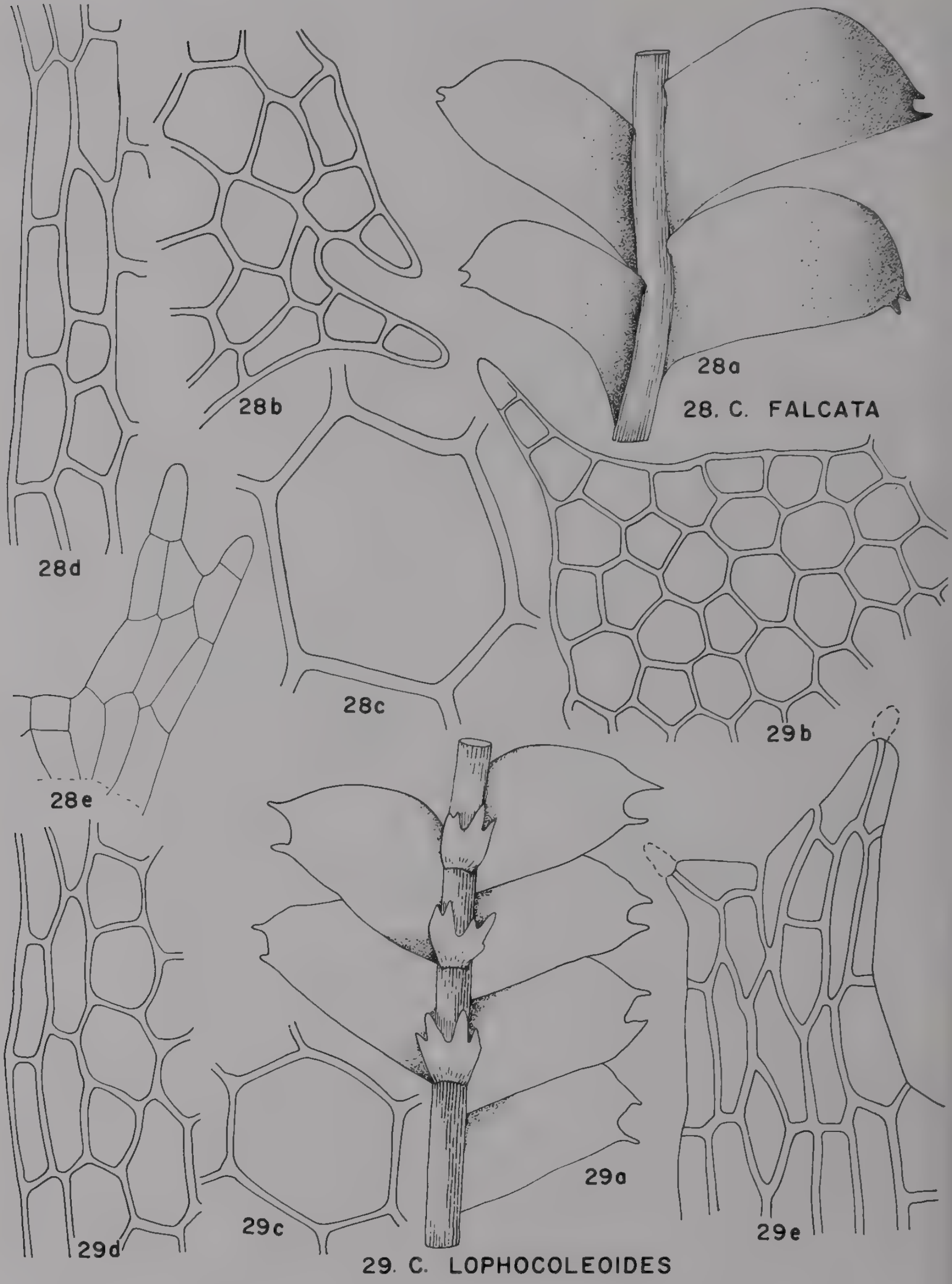
28a
28. C. FALCATA
28b
28c
28d
28e
29a
29b
29c
29d
29e
29. C. LOPHOCOLEOIDES

Plate 76

FIG. 28. *Calypogeia falcata*. 28 a. Stem, dorsal view, × 20. 28 b. Apex of a leaf, × 200. 28 c. Cell from the upper part of a leaf, × 500. 28 d. Dorsal marginal cells of a leaf, × 200. 28 e. Part of an underleaf, × 160. Drawn from the type.

FIG. 29. *C. lophocoleoides*. 29 a. Stem, ventral view, × 35. 29 b. Part of the apex of a leaf, × 200. 29 c. Cell from the upper part of a leaf, × 500. 29 d. Cells of the dorsal basal margin of a leaf, × 200. 29 e. Part of an underleaf, × 200. Drawn from the lectotype.

COLOMBIA: Amazonas-Vaupés: Río Apaporis, Soratama, 250 m, *Schultes & Cabrera 12791* (♀) (FH).

VENEZUELA: Amazonas: Río Cunucunuma, 1200 m, *Maguire, Cowan & Wurdack 29905* (NY).

BRAZIL: Cocui, *Spruce* (NY); Tauaú, *Spruce* (lectotype MANCH-Kk 960); San Carlos et flumen Uaupés, *Spruce, Hep. Spruc.* (BM, MANCH-Kk 1704m, NY, Y); San Gabriel, Rio Negro, *Spruce* (MANCH); Panuré, *Spruce, no. 275* (NY); Serra de Araripe, Ceará, *Lutzelburg* (S-PA); Caraça, *Wainio* (BM).

PARAGUAY: Cerro Léon, *Balansa 4335, Pl. d. Paraguay* (BM, C, G, NY).

27. **Calypogeia miquelii** Montagne in G. L. & N. Syn. Hep. 200. 1845.

Kantia miquelii (Montagne) Trevisan, Mem. Ist. Lomb. III. **4**: 425. 1877.

Plants of medium to large size, light to yellow-green becoming yellow-brown, in mats or among other bryophytes; stems prostrate, to 3 cm long, with leaves, to 3 mm wide, frequently asymmetric with the leaves of one side smaller for a distance, irregularly branched; branches numerous, leafy, ventral-intercalary from the axils of the underleaves. Rhizoids in dense tufts from the bases of underleaves. Line of leaf insertion longitudinal but curved at the upper end. Leaves distant to subimbricate, faintly bordered (the cells quite similar to those adjacent), long oval to long orbicular, 1.3–1.5 mm long, to 1.5 mm wide at the middle, the dorsal base straight, the ventral base weakly decurrent, the apex broad, rounded, shortly bifid, the teeth triangular from a broad base, to 4 cells high, the sinus U- or V-shaped; cells of the border of the lower half of the leaf 60–80 × 20–25 μ, of the upper part 26–39 × 26–39 μ, cells of the upper lamina 39–52 × 33–39 μ, the walls uniformly thickened, without trigones, the cuticle verruculose. Underleaves small, bisbifid, the outer segments shorter, obscured by the large tuft of rhizoids. Male and female inflorescences and sporophyte not seen.

Pl. 75. Fig. 27, a–e.

Habitat: On damp soil and logs or on leaves in montane forests.

SURINAM: s.l., Hb Miquel [*no. 1020*] (type PC); s.l., *Miquel*, Hb Bescherelle (G-1842); s.l., *Leprieur* (PC); s.l., Hb Hampe (BM).

28. **Calypogeia falcata** Bischler, Candollea **18**: 112. *f. 37.* 1962.

Plants of medium size, light yellow-green to olive-green, in mats or among other bryophytes; stems 1–2 cm long, with leaves to 3 mm wide, prostrate, occasionally branched, the branches leafy, ventral-intercalary from the axils of the underleaves. Rhizoids frequent, long, in hyaline tufts from the bases of the underleaves. Line of leaf insertion longitudinal except at the upper end. Leaves distant to approximate, bordered at least below, ovate, asymmetric, 1.4–1.6 mm long, × 0.9 mm wide at the middle, falcate, the ventral side shorter, the base decurrent, the dorsal margin above the middle strongly convex, the apex shortly bifid, the teeth sharp, 2 or 3 cells long from a 1- or 2-celled base, occasional leaves oblong and nearly symmetrical; leaf border below the middle of the leaf, of long cells 70–90 × 20–30 μ, the border in the upper part, of smaller cells similar to those adjacent; cells of the upper part of the leaf 42–65 × 40–52 μ, thin-walled, without trigones, the cuticle weakly verruculose. Underleaves small, cuneate in outline, bisbifid, the lamina mostly 2 rows of cells high, the sinus broad U-shaped, the teeth narrow or uniseriate, the cells long, thin-walled. Male and female inflorescences and sporophyte not seen.

Pl. 76. Fig. 28, a–e.

Habitat: On damp soil in wooded areas at low elevations.

DOMINICA: Lagona Flats, *Elliott* (type G-12419, BM); same locality, *Elliott 2127, 2128* (BM).

29. Calypogeia lophocoleoides Stephani, Spec. Hep. **3**: 409. 1908.

Calypogeia suringarii Stephani, Spec. Hep. **6**: 451. 1924.
Calypogeia portoricensis f. *laxa* Stephani, in Hb.

Plants of medium to large size, in dense dark green or yellowish mats or scattered among other bryophytes; stems stout, to 5 cm long, with leaves 2–2.5 mm broad, distantly pinnate; branches occasional, long, leafy, rarely small-leaved, ventral-intercalary from the axils of underleaves; stem in transverse section undifferentiated, the cortical cells similar to the rest. Rhizoids occasional, long, the tips branched, hyaline or brownish, in tufts from the bases of underleaves. Line of leaf insertion slightly oblique, curved above. Leaves imbricate, bordered in the lower half, truncate-ovate, 0.8–1.0 mm long, 0.5–0.6 mm wide below, narrowed to the bidentate apex, the segments triangular from a 2- to 4-celled base, ending in a 2- to 4-celled point, the sinus deep, U-shaped, the ventral margin bordered by 1 or 2 rows of long rectangular cells, not decurrent, the dorsal margin not so distinctly bordered; cells of the upper part of the leaf hexagonal, 40–55 × 30–40 μ, the walls uniformly thickened, the trigones tiny, the cuticle smooth. Underleaves distant, longer than broad, to 4.3 long, bisbifid, the middle sinus to one-half the length, the line of insertion curved, not decurrent, the cells long, hyaline, the walls thick, yellowish or brown. Male and female inflorescences and sporophyte not seen.

Pl. 76. Fig. 29, a–e.

Habitat: On damp soil and trees in montane forests.

DOMINICA: Morne Micotrin, *Elliott 1100a* p.p. (BM); summit, Mt. Micotrin, *Elliott 1136* (BM); s.l., *Elliott, Hep. Domin. Elliott, 1136* (lectotype G-12425); Roseau Lake, 2700 ft, *Elliott 1183* (BM).
GUADELOUPE: s.l., *l'Herminier* (G-1824).
SURINAM: Insula Saba, *Suringar 119*, the type of *C. suringarii* (G).

No specimens of the following taxa of *Calypogeia*, reported for Latin America, have been seen.

Kantia amazonica var. *inaequifoliata* Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 416. 1885. Flumen Uaupés.
Calypogeia annabanensis Stephani, Bibliot. Bot. **21**(87): 223. 1916. Bolivia. nomen nudum.
Calypogeia fistulata Mitten, in Thompson & Murray, Rept. on the . . . voyage of the H.M.S. Challenger . . . Botany **13**: 85. 1885. Juan Fernandez.
Kantia leptoloma Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 414. 1885. Brazil.
Kantia miquelii var. *oppositifolia* Spruce in Bescherelle & Spruce, Bull. Soc. Bot. Fr. **36**: clxxxiv. 1889. Guadeloupe.
Kantia uleana Stephani, Hedwigia **34**: 54. 1895. Brazilian tropics. [The packets available contained no *Calypogeia*.]

CEPHALOZIACEAE (Cavers) Jørgensen, Bergens Mus. Skr. **16**: 58. 1934.

Jungermannia subtribe Cephalozieae Dumortier, Recueil Obs. Jungerman. 17. 1835. p.p.
Trigonantheae Spruce, On *Cephalozia* 88. 1882. p.p.
Cephalozia Spruce, on *Cephalozia* 5. 1882.

Sporeling of the *Cephalozia* type, i.e., branched, uniseriate, filamentous, giving rise to a leafy shoot or to leafy sexual branches. Leafy stems branched, the branches lateral, of the *Frullania* type, or more frequently ventral-intercalary, leafy or short and bearing a male (rarely) or female inflorescence, or in some species the branch flagelliform. Rhizoids from the ventral side of the stem. Stem in transverse section with the cortical cells larger than those of the medulla (at least on the dorsal side). Leaves succubous or transverse, bifid. Underleaves very small or absent. Male inflorescence terminal becoming intercalary on a leafy axis, more rarely on a short ventral branch, the bracts resembling the leaves. Female inflorescence terminal on a short ventral branch, the bracts and bracteoles in 3 or 4 series, the innermost series largest, bifid. Perianth cylindrical below, with 3 rounded keels above, the third keel ventral (hypogonanthous). Gemmae often present, 1-celled, smooth or angled.

Type genus: *Cephalozia* (Dumortier) Dumortier, 1835.

Key to the Genera

1. Vegetative plant a persistent filamentous protonema with foliaceous male and female bracts. *Protocephalozia.*
1. Vegetative plant a leafy stem with branches.
   2. Leaves with a conspicuous inrolled watersac on the ventral margin. *Nowellia.*
   2. Leaves without a watersac. *Cephalozia.*

Cephalozia (Dumortier) Dumortier, Recueil Obs. Jungerm. 18. 1835.

Jungermannia sect. *Cephalozia* Dumortier, Syllog. Jungerm. 60. 1831. p.p.
Jungermannia sect. *Bicuspides* Nees, Naturg. Eur. Leberm. **2**: 211. 1836.
Trigonanthus Spruce, Trans. Proc. Bot. Soc. Edinb. **3**: 207. 1849.
Cephalozia subg. *Eucephalozia* Spruce, On *Cephalozia* 30. 1882.

Plants small, light green, whitish or brown to reddish, prostrate or ascending, in mats or with other bryophytes; branches occasionally lateral, of the *Frullania* type, usually ventral-intercalary, leafy or short and bearing a male or female inflorescence, in some species often flagelliform; stem in transverse section with up to about 15 cortical rows, the cells larger than those of the medulla at least on the dorsal side. Rhizoids from the ventral side of the stem. Line of leaf insertion oblique, nearly longitudinal to nearly transverse. Leaves rotundate-ovate to long-ovate, often decurrent, bifid to one-third or one-half their length, the segments entire. Underleaves absent or of only a few cells or as slime papillae. Plants monoicous or dioicous. Male inflorescence spike-like, short, ventral or terminal becoming intercalary on the leafy axis; bracts larger or smaller than the leaves, bifid, pouched. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, similar to but larger than the leaves, sometimes coalesced at the base. Perianth long, cylindrical below, with three rounded keels above, the mouth narrowed, toothed, cleft, setulose or crenulate. Shoot-sporophyte relationship a shoot-calyptra. Sporophyte capsule oblong, light to dark brown, the wall 2-layered, with characteristic thickenings, the elaters arranged diagonally or transversely from the walls, the free ends converging toward the center of the capsule. Seta in section of 8 large outer cells and 4 small inner cells. Gemmae when present 1-celled, in green or reddish clusters on the tips of the stems.

Type species: *Jungermannia bicuspidata* Linnaeus, 1753.

Key to the Species

1. Leaves nearly longitudinally inserted, more or less decurrent; leaf segments narrowly triangular from a 2- or 3-celled base.
   2. Tip cell of the leaf segment 3 or 4 times as long as wide; segments more or less straight, the tip 2, or rarely 3 cells long. 3. *C. caribbeania.*
   2. Tip cell of the leaf segment rarely more than twice as long as wide.
      3. Leaf segments connivent, the tip of 1 or 2 cells.

      4. Leaf segments acuminate, the tip of 2 cells 39–52 μ or rarely to 78 μ long. 1. *C. crassifolia.*
      4. Leaf segments acute with a 1-celled tip, the cell about 30 μ long. 4. *C. media.*
    3. Leaf segments more or less straight, the tip 2, more often 3 cells long. 2. *C. subforficata.*
1. Leaves obliquely or transversely inserted, not decurrent.
  2. Leaf segments narrowly triangular from a 3- to 4-celled base; leaves subtransversely inserted; plants whitish or rarely tinged with brown.
    3. Leaf tip 2 or 3 cells long. 8. *C. dussii.*
    3. Leaf tip 5 or 6 cells long. 9. *C. bischlerae.*
  2. Leaf segments broadly triangular from a base 6 or more cells wide (rarely only 4 cells wide).
    3. Leaf segments strongly connivent. 4. *C. media.*
    3. Leaf segments straight or curved but not connivent.
      4. Plants greenish or whitish; leaves obliquely inserted.
        5. Leaves bifid to one-half their length, the segments mostly 8 or more cells long. Plants of the Caribbean and northward. 5. *C. bicuspidata.*
        5. Leaves bifid to about one-third their length, the segments mostly 6 cells long. Plants of Patagonia. 7. *C. patagonica.*
      4. Plants brown, at least in the outer parts.
        5. Leaves more or less complicate-keeled, approximate to imbricate, patent; dorsal and ventral leaf bases strongly convex to cordate; leaf insertion transverse. 11. *C. physocaula.*
        5. Leaves usually more or less concave, the segments variously spreading or incurved.
          6. Leaf segments broadly triangular, usually ending in a blunt apex, the cells mostly quadrate in outline; leaf insertion oblique. [Plants from Bolivia.] 6. *C. grandifolia.*
          6. Leaf segments acute; leaf insertion subtransverse. [Plants of Patagonia and Antarctica.]
            7. Leaf segments long, slender, acute to short acuminate with most of the cells longer than broad. 10. *C. tubulata.*
            7. Leaf segments broadly triangular, with most of the cells isodiametric.
              8. Plants tiny; leaves deeply concave cup-shaped. 13. *C. cucullifolia.*
              8. Plants larger; leaves often concave but never cup-shaped. 12. *C. badia.*

1. **Cephalozia crassifolia** (Lindenberg & Gottsche) Fulford, comb. nov.

Jungermannia crassifolia Lindenberg & Gottsche in G. L. & N. Syn. Hep. 685. 1847.
Blepharostoma sandvicensis Trevisan, Mem. Ist. Lomb. III. **4**: 417. 1877.
Cephalozia forficata Spruce, On *Cephalozia* 46. 1882.
Cephalozia subg. 5 *Eucephalozia, forficata* Spruce, On *Cephalozia* 46. 1882.
Cephalozia sandvicensis auct. [American plants.]

Plants small, slender, pale green tinged with brown, in mats or scattered among other bryophytes; stems prostrate, pellucid, 1–1.5 cm long, with leaves 0.5–0.8 mm wide, irregularly branched; branches ventral-intercalary, leafy, often bearing male or female inflorescences. Rhizoids from cells of the ventral side of the stem, the tips branched. Line of leaf insertion nearly longitudinal. Leaves distant to approximate, plane, widely spreading to slightly ascendant, decurrent, suborbicular, 0.4–0.5 mm long, 0.3 mm wide, often smaller toward the tip of the stem, the lateral margins convex, bilobed to one-fourth the length, the segments connivent, short, triangular-acuminate, ending in two single cells; cells of the tip 39–52 μ, very rarely to 65 μ long, 13–18 μ wide, cells below the sinus mostly 52–65 × 39–50 μ, with 1 cell often much smaller, the walls uniformly thickened, without trigones, the cuticle smooth. Underleaves absent. Female inflorescence on a short ventral branch with few leaves, the bracts and bracteoles in 3 or 4 series, bifid, the segments triangular, entire. Perianth long, cylindrical below, 3-keeled above, the mouth ciliate, the cilia 3 or 4 cells long, the basal cell to 78 μ, the tip cell 78 × 26 μ. Male inflorescence and sporophyte not seen.

Pl. 77. Fig. 1, a–e.

Habitat: On moist rocks, logs, banks and trees and among other bryophytes in wooded areas.

MEXICO: Oaxaca: Tepinapa, 2000–2500 ft, *Liebmann* (isotypes BM, S-PA); s.l., *Karsten* (BM, G-13216); s.l., *Müller* (BM); Orizaba, *F. Müller* (NY).

COLOMBIA: La Macarena, Caño Tiranao, 1700 m, *Schultes 11248* p.p., *11255* (FH); s.l., *Weir* (NY); Andes Bogotá, *Weir* (NY).

VENEZUELA: Amazonas: Río Cunucunuma, Cumbre, 1200 m, *Cowan & Wurdack 30698* p.p. (NY); Río Ventuari, base of w escarpment, 1800 m, *Cowan & Wurdack 31279* p.p. (NY); Cerro de La Neblina, Río Yatua, 700–1100 m, *Wurdack & Maguire 42546* p.p. (♀) (NY). Bolívar: Chimantá Massif, 1940–1700 m, *Steyermark & Wurdack 624* p.p. (NY); Ptari-tepuí, 2410 m, *Steyermark 59893* p.p. (F); Falcón: Cerro Santa Ana, 800–850 m, *Steyermark 94568* p.p. (VEN).

BRAZIL: S. Paulo: Alto da Serra, 900 m, *Schiffner 404* p.p., *581* (UPS).

ECUADOR: s.l., *Jameson* (NY).

PERU: Monte Guayrupurina, *Spruce*, *Hep. Spruc.*, type of *C. forficata* (MANCH, isotypes BM, NY); Monte Campana, 1300 m, *Spruce* (MANCH); Tatanura, without coll. (S-PA).

2. Cephalozia subforficata Herzog, Rev. Bryol. Lichén. **11**: 17. *f. 1, g–h.* 1938.

Plants small, slender, pale green often tinged with brown, in mats or scattered among other bryophytes; stems prostrate, 1–2 cm long, with leaves 0.4–0.6 mm wide, irregularly branched; branches ventral-intercalary, leafy or rarely flagelliform, or short and bearing a male or female inflorescence. Rhizoids frequent, from cells of the ventral side of the stem, the tips branched. Line of leaf insertion nearly longitudinal. Leaves distant to approximate, plane, widely spreading to slightly ascendant, falcate, the dorsal margin strongly convex, 0.5 mm long, 0.15 mm wide, often smaller with the cells in rows, in leaves near the tip of the stem, decurrent, bilobed to one-third the length, the segments erect to slightly curved, not connivent, long, triangular from a 2-celled base, the tip a row of 2 or 3 cells; cells of the tip to twice as long as wide, 26–30 μ long, cells of the upper part of the leaf variable 45–52 μ long and wide, with a few 26–35 μ, the walls thin, without trigones, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence on a ventral branch, spike-like, the bracts resembling the leaves, densely imbricate, bilobed, concave. Female inflorescence on a short branch, the bracts and bracteoles in 3 or 4 series, bifid, the segments of the inner series slender, long-acuminate, ending in a row of 3 cells. Perianth long cylindrical below, 3-keeled above, the mouth long-ciliate, the cilia 3 or 4 cells long, the cells mostly 130 × 20 μ. Sporophyte not seen.

Pl. 77. Fig. 2, a–f.

Habitat: On decayed logs.

JAMAICA: Cuna Cuna Mountain, *M. Farr 1335* p.p. (IJ); between Sir John and High Peaks, *Lewis 70* p.p., *71* (IJ).

PUERTO RICO: Luquillo Mountains, *Steere 4442* p.p. (Hb Fulford); Jayuya near Los Picachos, 3250 ft, *Pagán 309* (NY).

TRINIDAD: s.l., *Fendler* (NY).

GUATEMALA: Alta Verapaz, Cubilguitz, 350 m, *Türckheim* (NY); El Progreso: near Volcán Santa Luisa, 2400–3333 m, *Steyermark 43527* p.p. (F); Chiquimula, *Steyermark 21037* (F); Quezaltenango: Cerro de Sija, 10,000 ft, *Sharp 5049* p.p. (TENN).

COSTA RICA: San José: Laguna de la Choreta, 2000–2100 m, *Standley 42299* (type Hb Herzog); s.l., *Standley 42711* (Hb Grolle).

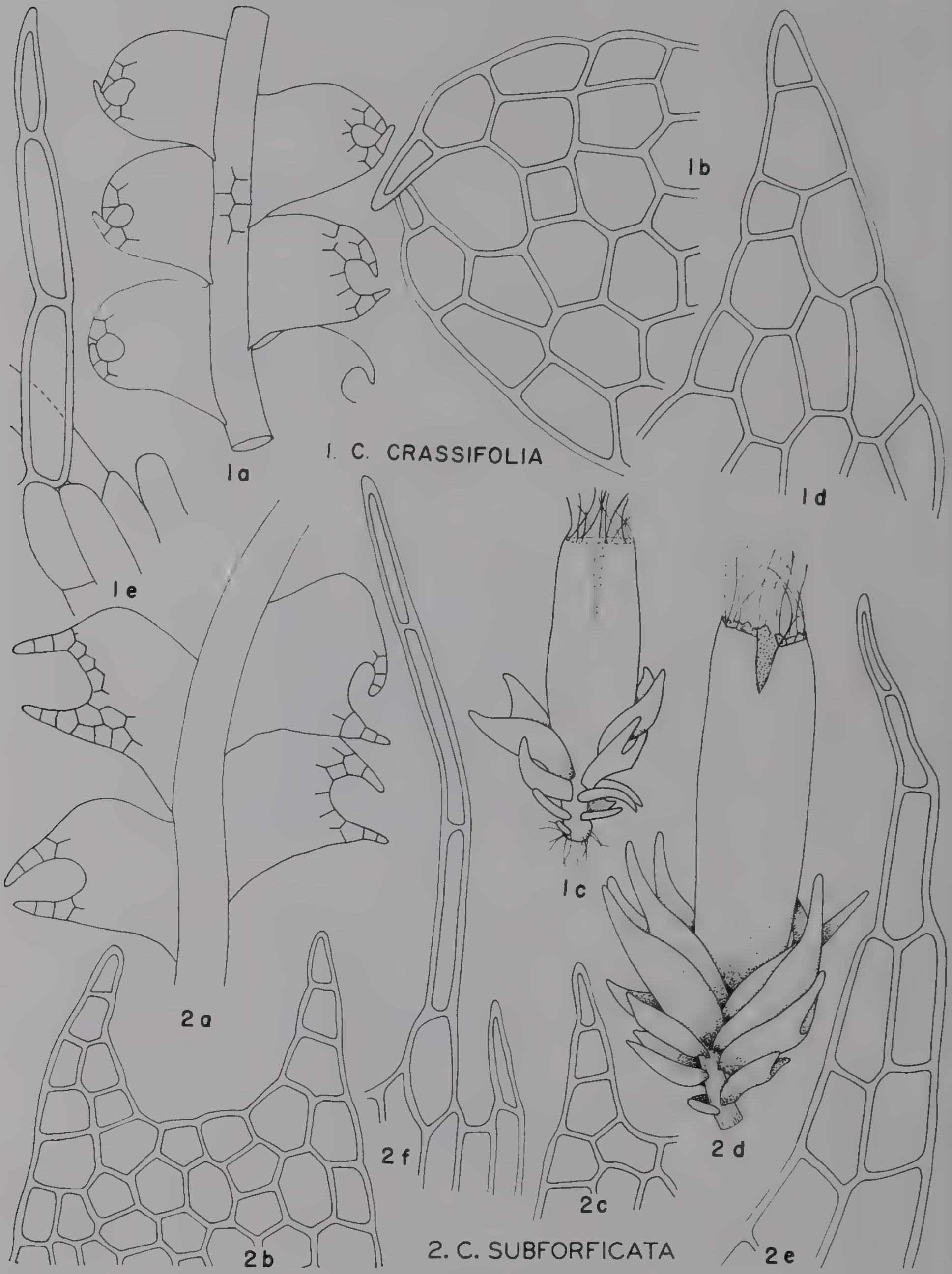

Plate 77

FIG. 1. *Cephalozia crassifolia.* 1 a. Stem, dorsal view, × 50. 1 b. Upper part of a leaf, × 200. 1 c. Female inflorescence and perianth, × 20. 1 d. Upper part of a female bract, inner series, × 200. 1 e. One of the cilia of the perianth mouth, × 200. Drawn from the type of *C. forficata* Spruce.

FIG. 2. *C. subforficata.* 2 a. Stem, dorsal view, × 50. 2 b. Upper part of a leaf, × 200. 2 c. Another leaf segment, × 200. 2 d. Female inflorescence and perianth, × 50. 2 e. Tip of a female bract, inner series, × 200. 2 f. One of the cilia of the perianth mouth, × 200. Drawn from the type.

3. **Cephalozia caribbeania** Fulford, sp. nov.

Cephalozia sandvicensis, Wright, *Hep. Cub. Wright.*, in Hb. Non *C. sandvicensis* (Montagne).

Caules parvi, subtiles, subvirides brunnei-suffusi, 1–3 cm longi, ramis ventrali-intercalaribus, foliis sublongitudinaliter insertis. Folia patentia, ovato-truncata, bifida, segmentis rectis vel curvatis, apicibus 2 vel 3 cellulis; apicis cellulae 65–104 × 15–26 μ; laminae cellulae 65–78 × 65–78 μ, pariete uniformiter incrassata. Amphigastria obsoleta. Inflorescentia masculina ventralis, bracteis similibus foliis; inflorescentia femina ventralis, bracteis bifidis acutis. Perianthii os longe ciliatum, cellulis 150 × 26 μ.

Plants small, slender, pale green tinged with brown, in depressed mats or among other bryophytes; stems 1–3 cm long, with leaves 0.5–1.0 mm wide, irregularly branched, the branches ventral-intercalary, leafy, or short and often bearing a male or female inflorescence. Rhizoids frequent, from the ventral side of the stem, often branched at the tips. Line of leaf insertion nearly longitudinal. Leaves distant to approximate, plane, widely spreading to slightly ascendant, ovate 0.5–0.65 mm long, 0.25–0.45 mm wide, the dorsal margin convex, bifid to one-third their length, the segments usually straight, long triangular, acuminate from a 2-celled base, ending in a tip of 2 long cells, each 4–6 or more times as long as wide; cells of the segment tip mostly 65–104 × 15–26 μ, of the sinus margin 65–85 × 65–68 μ, a few smaller, the walls uniformly thickened, without trigones, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or on a short branch, the bracts in many series, resembling the leaves, densely imbricate, concave. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, bifid, the segments entire, those of the innermost series long-acuminate, the tip cell very long. Perianth cylindrical below, with 3 broad rounded keels above, the mouth long-ciliate, the cilia mostly 5 cells long, the cells often 150 × 26 μ.

Pl. 78. Fig. 3, a–e.

Habitat: On logs, trees, soil and banks, in humid forests.

CUBA: s.l., *Wright*, *Hep. Cub. Wright*, as *C. sandvicensis* (type MANCH, G-13217); Oriente: Sierra Maestra, *Morton 9545* p.p., *9628* p.p. (US); Punte de Palma-mocha, 1350 m, *Ekman 5244* (S-PA).

JAMAICA: s.l., *Wilson* (NY); s w of Ecclesdown, *M. Farr 1146* (F); s.l., *Webster* (NY); John Crow Peak, *Evans 87*, *123* (Y, BM).

PUERTO RICO: Luquillo Mountains: lower slopes of Mt. Britton, *Fulford*, *Crandall & Stotler 657* p.p., *658* p.p. (Hb Fulford); El Yunque, *Biebl* (Hb Grolle).

GUADELOUPE: s.l., l'Herminier (G-13218).

DOMINICA: near Laudat, *Elliott 502a* p.p. (BM); Morne Diablotin, *Elliott 2106* (type BM).

TRINIDAD: s.l., *Crüger* (G).

MEXICO: Oaxaca: above Finca, n of Niltepec, 2700 ft, *Sharp 5782* (TENN).

GUATEMALA: Zacapa; Sierra de Las Minas, 2500 m, *Steyermark 29967* (F); El Progreso: near Volcán Santa Luisa, *Steyermark 43525* p.p. (F); El Progreso: Finca Bucaral, 6500 ft, *Sharp 2767* (TENN).

HONDURAS: Morazán: Cerro Uyuca, Caño Lamor, *M. Carlson 2489* (F); Cerro de Uyuca, near summit, *Standley 759* p.p. (F); Morazán: Cerro de Uyuca, 1600 m, *Standley 4810* (F).

VENEZUELA: Bolívar: Chimantá Massif, near 'Summit Camp,' 1880–1920 m, *Steyermark & Wurdack 1182* p.p. (NY); Río Venamo, 950–1400 m, *Steyermark 92296* p.p. (VEN). Falcón: Cerro Santa Ana, near summit, 800–950 m, *Steyermark 94552* p.p. (VEN). Sucre: Peninsula de Paria: Cerro de Humo, 1060–1273 m, *Steyermark 94994* p.p. (VEN). Cerro de Humo, 800–1000 m, *Steyermark 95108* m (VEN).

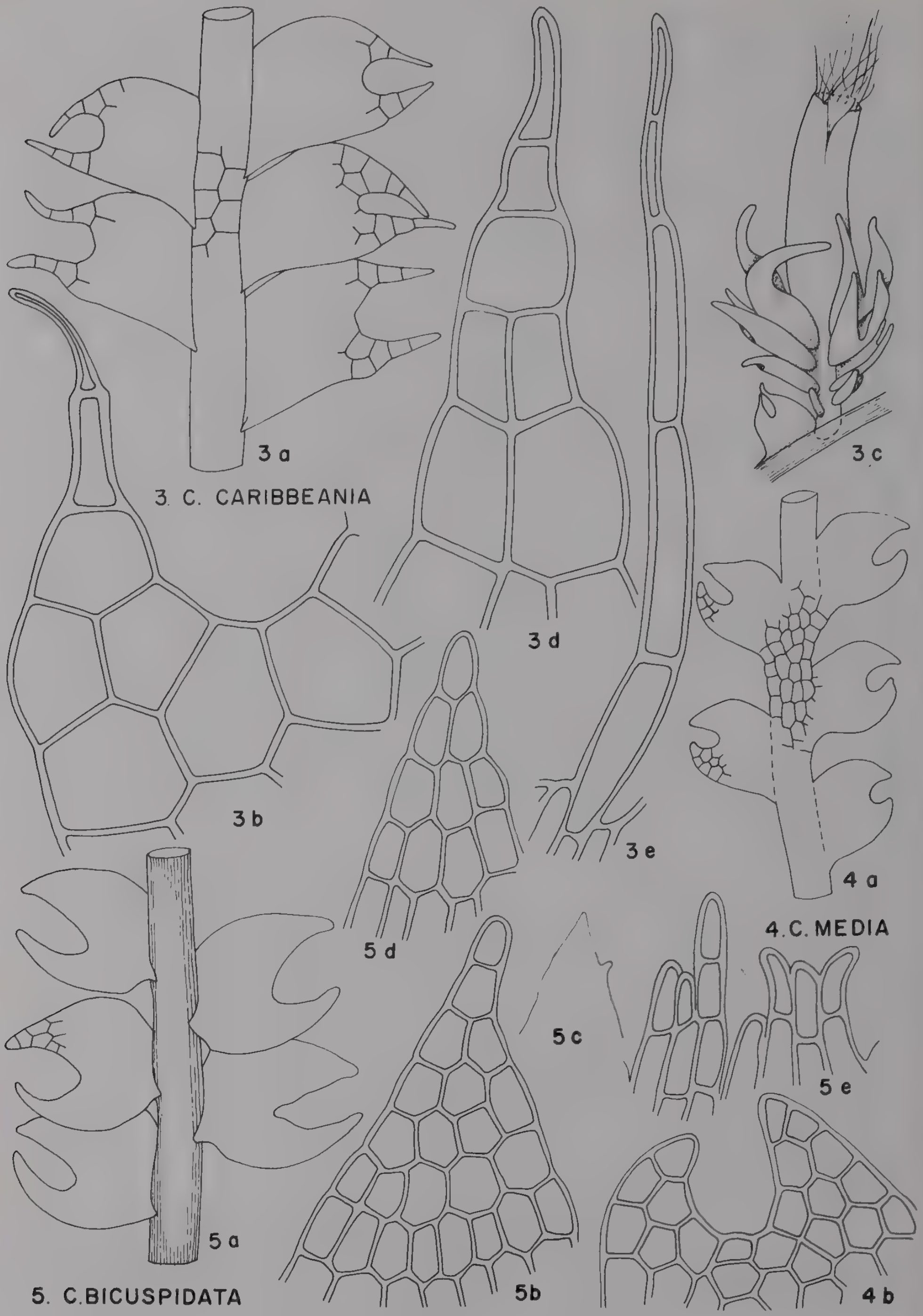
3 a
3. C. CARIBBEANIA
3 d
3 c
3 b
3 e
4 a
4.C. MEDIA
5 d
5 c
5 e
5 a
5. C.BICUSPIDATA
5b
4 b

Plate 78

FIG. 3. *Cephalozia caribbeania.* 3 a. Stem, dorsal view, × 50. 3 b. Cells of a portion of a leaf, × 200. 3 c. Female inflorescence and perianth, × 50. 3 d. Tip of a female bract, inner series, × 200. 3 e. One of the cilia of the perianth, × 200. Drawn from the type.

4. Cephalozia media Lindberg, Meddl. Soc. Fauna Fl. Fennica **6**: 242. 1881.[5]

Plants small, green to whitish, prostrate in mats or scattered among other bryophytes; stems 1–2 cm long, with leaves 1–1.3 mm broad, occasionally branched, the branches lateral, of the *Frullania* type, or more frequently, ventral-intercalary, leafy, some of them short and bearing female inflorescences. Rhizoids from the ventral side of the stem. Line of leaf insertion oblique, nearly longitudinal. Leaves distant to approximate, plane, spreading-ascendant, decurrent, rotund-ovate, 0.27 × 0.2 mm, bilobed to one-third the length, the segments connivent, triangular from a 2- or 3-celled base, acute with a 1-celled tip; cells of the base of the segment 25–32 × 25–30 μ, the walls uniformly thin, without trigones, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on a stem or branch, the bracts resembling the leaves, closely imbricate, erect, concave. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, larger than the leaves, bifid to one-third their length, the margins entire or nearly so. Perianth long cylindrical below, with 3 rounded keels above, the mouth narrowed, truncate, crenulate-denticulate, the teeth 1 or 2 cells long. Gemmae and sporophyte not seen.

Pl. 78. Fig. 4, a–b.

Habitat: On soil banks in mountainous areas. [In the West Indies.]

CUBA: Oriente: Sierra Maestra, 1400 m, *Ekman 7115* (S-PA, UPS).

5. Cephalozia bicuspidata (Linnaeus) Dumortier, Recueil Obs. Jungerm. 18. 1835.

Jungermannia bicuspidata Linnaeus, Sp. Pl. 1132. 1753.
Cephalozia colombica S. Arnell, in Hb.

Plants in light green to whitish or occasionally reddish to brownish mats or scattered among other bryophytes; stems prostrate, 1–2 cm long, with leaves to 1 mm broad, irregularly branched, the branches lateral, of the *Frullania* type, more frequently ventral-intercalary, leafy, flagelliform, or short with a male or female inflorescence. Rhizoids frequent, from the ventral side of the stem. Line of leaf insertion oblique. Leaves distant to imbricate, usually plane, ovate in outline, bifid to one-half the length, the segments triangular from a 4- to 8-celled base, ending in a tip two cells long; cells mostly longer than broad, those of the segment 33–39 × 26 μ, uniformly thin-walled, without trigones, the cuticle essentially smooth. Underleaves absent. Plants dioicous and monoicous. Male inflorescence terminal becoming intercalary on a stem, the bracts much like the leaves, ascending, imbricate, concave. Female inflorescence on a short ventral branch, the bracts and bracteoles larger than the leaves, bifid, the segments lanceolate, the margin with occasional teeth or projecting cells. Perianth long, cylindrical below, with 3 rounded keels above, the mouth narrowed, truncate, crenulate and setulose. Gemmae not seen on Latin American plants.

Pl. 78. Fig. 5, a–e.

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[5] For more complete synonymy see a manual of Hepaticae of Europe or North America.

FIG. 4. *C. media*. 4 a. Stem, ventral view, × 50. 4 b. Cells of the upper part of a leaf, × 200. Drawn from material from Cuba, *Ekman 7115*.

FIG. 5. *C. bicuspidata*. 5 a. Stem, dorsal view, × 50. 5 b. Cells of one segment of a leaf, × 200. 5 c. Outline of upper part of a female bract, inner series. 5 d. Tip of a female bract, inner series, × 200. 5 e. Portion of a perianth mouth, × 200. Drawn from plants from Mexico, *Sharp 986*.

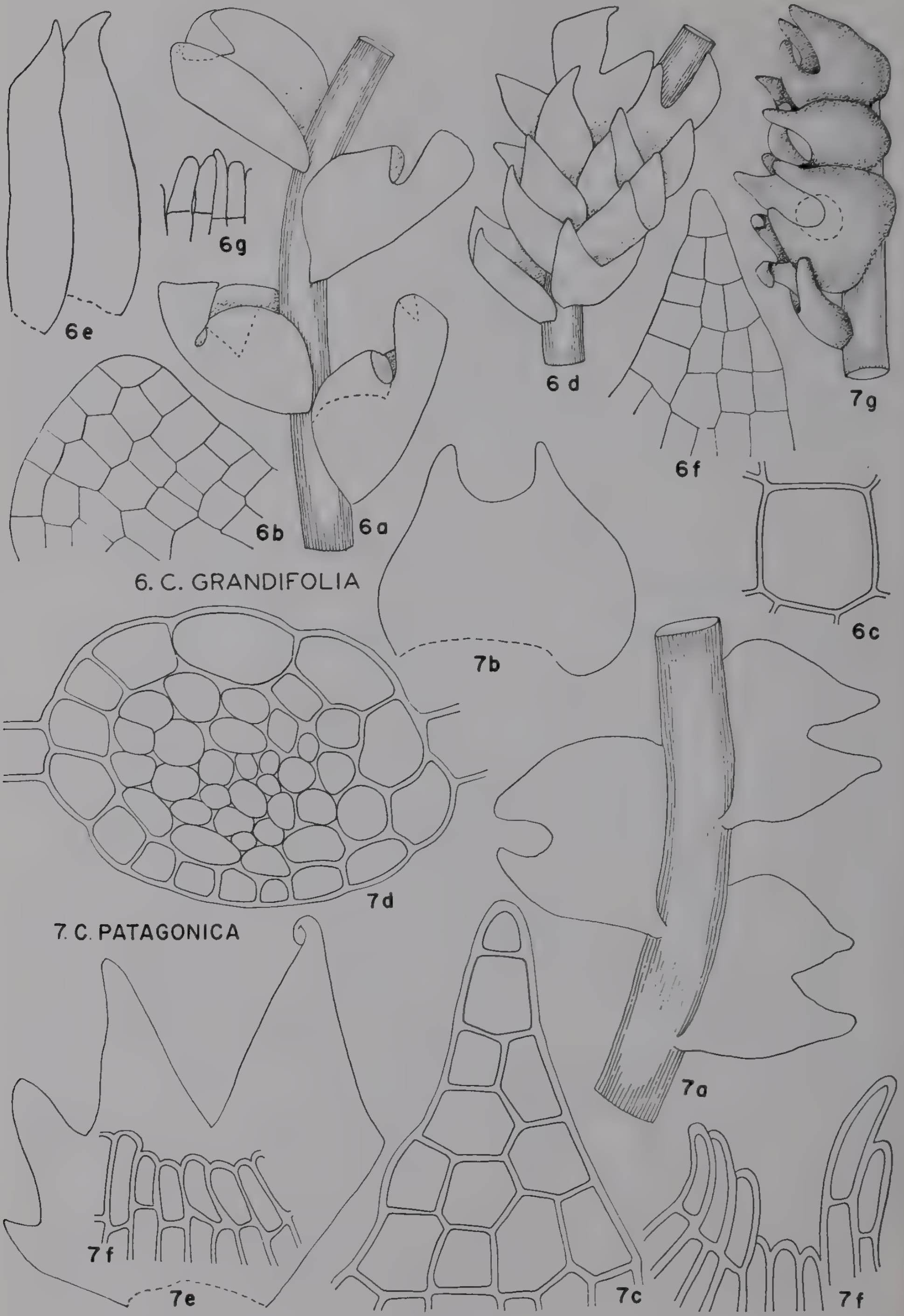
6e
6g
6 d
7g
6f
6b
6a
6. C. GRANDIFOLIA
7b
6c
7d
7. C. PATAGONICA
7a
7f
7e
7c
7f

Plate 79

FIG. 6. *Cephalozia grandifolia.* 6 a. Stem, dorsal view, × 50. 6 b. Upper part of a leaf segment, × 200. 6 c. Leaf cell, × 500. 6 d. Male inflorescence, × 50. 6 e. Female bract, inner series, × 50. 6 f. Tip of a segment of this bract, × 200. 6 g. Portion of the perianth mouth, × 200. Drawn from the type, *Herzog 3119.*

Habitat: On soil, moist banks and along paths at high elevations. [In Central America.] Widespread in the Northern Hemisphere.

MEXICO: Chiapas: near Las Casas, 7300 ft, *Sharp 3361* (TENN); Puebla: between Zotalapa and Catalina, w of Huauchinango, 6200 ft, *Sharp 986* (♀) (TENN).

GUATEMALA: s.l., *Godman & Sabe* (♀ ♂) (NY). Quezaltenango: above Chiquival, 7500 ft, *Sharp 2024* p.p., *2050* (TENN); Gatena area, n of Sija, 9500 ft, *Sharp 2206, 2225, 2229, 2242* (TENN); Las Nubes, 2250 m, *Standley 85141* (F). San Marcos: n of Palestina, 9000 ft, *Sharp 2633* (TENN). e of Totonicapán, *Sharp 2606* (TENN).

COLOMBIA: Buyacá, *Grubb & Guyner*, type of *C. colombica* (S-PA).

6. Cephalozia grandifolia Stephani, Bibliot. Bot. **21**(87): 222. 162. 1916.

Plants of medium size, whitish-green tinged with reddish-brown in the outer part, in mats or among other bryophytes; stems 1.5–2 cm long, with leaves 0.8–1.0 mm wide (if spread), sparingly branched; branches lateral, leafy, of the *Frullania* type, and ventral-intercalary, flagelliform or short female; stem thick, in transverse section of a cortical layer of large thin-walled cells, the medulla of smaller cells. Rhizoids abundant on the ventral side of the stem. Line of leaf insertion oblique. Leaves distant or rarely imbricate, incurved, broadly ovate in outline, bifid to one-third their length, the sinus narrow U-shaped, the segments triangular from a broad base, the apex blunt-pointed; cells of the segments mostly 30 × 30 μ, the walls thin, without trigones, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem, the bracts imbricate, in 3–5 pairs, similar to the leaves, smaller, transverse. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, oblong, bifid, the margins entire. Perianth cylindrical below, 3-keeled above, the mouth irregularly crenulate and setulose. Young capsule showing the *Cephalozia*-type arrangement of elaters and spores in horizontal lines from the capsule wall.

Pl. 79. Fig. 6, a–g.

Habitat: On logs.

BOLIVIA: Viloco, 4500 m, *Herzog 3119* (type G-13203), *3113* (♀) (G-13204, S-PA).

7. Cephalozia patagonica Fulford, sp. nov.

Plantae parvae, albidae, turgidae; caules crassi, ramis ventrali-intercalaribus, saepe patulis geminis, folia oblique inseraa, late ovata, bifida, segmentis, triangularibus; cellulae 33–42 × 33–39 μ, parietibus tenuibus. Amphigastria obsoleta. Inflorescentia masculina intercalaris, bracteis similibus foliis. Bractae femineae bracteolaeque in 3–4 seriebus, bracteis interioribus 1–2 segmentis obtusis in margine dorsali instructis. Perianthii os irregulariter crenulatum.

Plants of small to medium size, light yellow-green to dull green, in patches or among other bryophytes. Stem thick, turgid, in robust plants 1–2 cm long, with leaves, to 1.5 mm wide, irregularly branched; branches frequent, leafy, ventral-intercalary, often widely spreading in opposite pairs; stem in transverse section 6–8 cells across, the cells of the cortical layer in many rows with the ventral rows smaller, the cells of the medulla mostly smaller with thicker walls. Rhizoids abundant from the ventral side of the stem. Line of leaf insertion oblique. Leaves spreading or the

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Fig. 7. *C. patagonica*. 7 a. Stem, dorsal view, × 50. 7 b. Leaf, × 50. 7 c. Segment of a leaf, × 200. 7 d. Transverse section of a stem, × 200. 7 e. Female bract, innermost series, × 40. 7 f. Portion of the mouth of a perianth, × 200. 7 g. Male inflorescence, × 50. Fig. 7, a–e, g, drawn from the type; Fig. 7 f from *Fulford & Hatcher 288*.

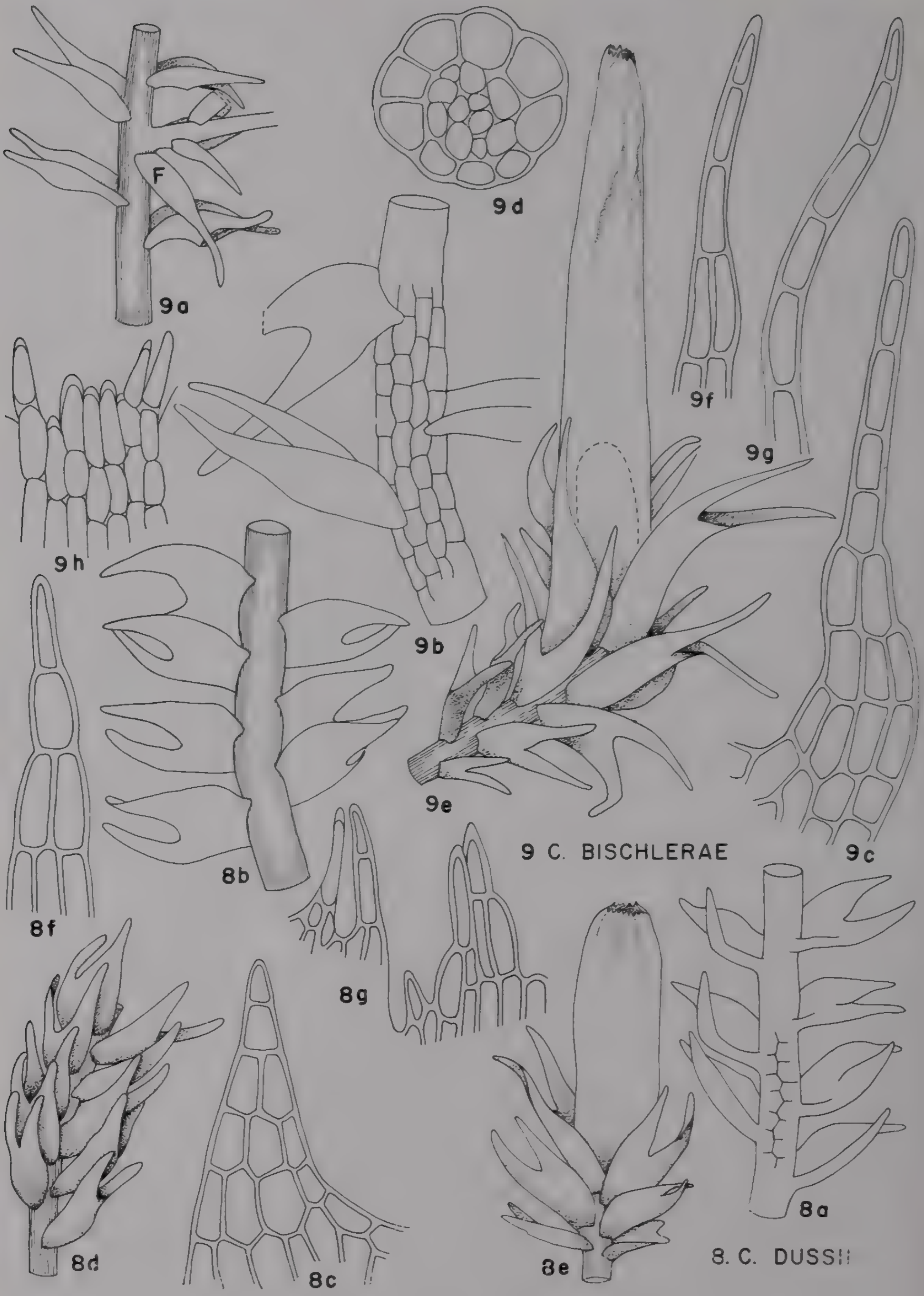
9a
F
9d
9f
9g
9h
9b
9e
9c
9 C. BISCHLERAE
8f
8b
8g
8d
8c
8e
8a
8. C. DUSSII

Plate 80

FIG. 8. *Cephalozia dussii*. 8 a. Stem, dorsal view, × 50. 8 b. Stem, ventral view, × 50. 8 c. Segment of a leaf, × 200. 8 d. Male inflorescence, × 50. 8 e. Female inflorescence and perianth, × 50. 8 f. Tip of a female bract, innermost series, × 200. 8 g. Portion of the mouth of the perianth, × 200. Drawn from the type.

2 rows more or less appressed, broadly ovate-truncate, to 0.52 mm broad, to 0.48 mm high, bifid to one-third the length, the lateral margins convex, not decurrent; segments broadly triangular from a base 6–10 cells wide, ending in a tip 1 or 2 cells long, the sinus broad V- or U-shaped; cells of the base of the segment mostly 33–42 × 33–39 μ, with thin walls, scarcely evident trigones and smooth cuticle. Underleaves absent. Plants dioicous. Male inflorescence terminal or becoming intercalary on a stem, the bracts in 3–6 or more pairs, similar to the leaves but smaller, monandrous. Female inflorescence terminal on a short leafy branch, the bracts and bracteoles in 3 or 4 series, larger than the leaves, the outer series bifid, the large innermost bracts bifid and with 1–2 large blunt marginal outgrowths below the middle. Perianth cylindrical below, more or less three-keeled above, the mouth crenulate and with a few longer setae. Sporophyte not seen.

Pl. 79. Fig. 7, a–g.

Habitat: Over mosses and *Sphagnum*, particularly in bogs.

CHILE: 198 k n of Punta Arenas, *Sphagnum* Bog, *Fulford & Hatcher 210* p.p., *225* p.p. (Hb Fulford). 190 k n of Punta Arenas, *Sphagnum* Bog, *Fulford & Hatcher 244, 245, 248a* p.p., *256* p.p., *259, 262, 266* (♀), *274, 276, 277* p.p., *279, 282, 283* (type), *285, 286* p.p., *288* p.p. (Hb Fulford); same locality, *G. Hassel de Menéndez 11177* p.p. (BA).

8. **Cephalozia dussii** Fulford, sp. nov.

Plantae parvae, subvirides; folia subtransverse inserta, bifida, segmentis triangularibus. Amphigastria obsoleta. Inflorescentia masculina intercalaris in caule, bracteis foliiformibus, parvioribus. Bracteae feminae bracteolaeque in 3 seriebus, similibus foliis, maiores. Perianthii os crenulatum et breviciliatum.

Plants small, greenish-white, in mats and among other bryophytes; stems slender, 1–2.5 cm long, with leaves 0.5–0.8 mm wide, irregularly branched, the branches lateral, leafy, of the *Frullania* type or ventral-intercalary, long leafy or long, often branched, flagelliform, or short and bearing a female inflorescence; stem in transverse section with the dorsal rows of the cortical layer of large cells and the ventral rows of small cells. Rhizoids from the ventral side of the stem. Line of leaf insertion oblique, subtransverse. Leaves 0.4–0.6 mm long, erect-spreading, bifid to one-half, the segments narrowly triangular from a 3- or 4- celled base, ending in a tip of 2 or 3 cells; cells of the base of the segment 39–50 × 20–26 μ, the walls uniformly thickened, the cuticle essentially smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts in 6–12 pairs, imbricate, similar to the leaves. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, deeply bifid, the segments like the leaf segments. Perianth long exserted, cylindrical below, 3-keeled above, the mouth irregularly crenulate and setulose.

Pl. 80. Fig. 8, a–g.

Habitat: On decayed logs in shaded areas.

GUADELOUPE: Bois de Sofaga, 460 m, *Duss 49* (type G-618, NY).

MARTINIQUE: Morne de la Calebasse, 690 m, *Duss 215* p.p. (NY); Morne Molelyane, 830 m, *Duss 256* (NY).

MEXICO: Puebla: w of Huauchinango, *Sharp 986* (TENN).

BOLIVIA: Gran Poder, *W. Brooke 6295B* p.p. (BM).

FIG. 9. *C. bischlerae.* 9 a. Stem, dorsal view, × 35; F, half-leaf with the *Frullania* type branch. 9 b. Stem, ventral view, × 50. 9 c. Segment of a leaf, × 200. 9 d. Transverse section of a stem, × 200. 9 e. Female inflorescence and perianth, × 35. 9 f–g. Tip of a female bract, innermost series, × 200. 9 h. Portion of a perianth mouth, × 200. Drawn from the type.

9. Cephalozia bischlerae Fulford, sp. nov.

Caules albo-virides, ramis typo *Frullaniae* vel ventrali-intercalaribus, foliis subtransverse insertis; folia longe rectangularia, patentia, bifida, segmentis longe lanceolatis, apicibus 3–4 cellularum. Amphigastria obsoleta. Monoica. Inflorescentia masculina terminalis, bracteis parvis foliiformibus. Inflorescentia femina in ramo brevi ventrali, bracteis bracteolisque in 3–4 seriebus, longioribus quam foliis, bifidis. Perianthium longum, ore brevi-ciliato.

Plants whitish-green, prostrate with the tips ascending, in mats or among other bryophytes; stems 1–3 cm long, irregularly branched, the branches lateral, of the *Frullania* type or ventral-intercalary and leafy or short and bearing a female inflorescence. Stem in transverse section of a cortical layer of large cells on the dorsal side and small cells on the ventral side, surrounding a medulla of rather small cells. Rhizoids from the ventral side of the stem. Line of leaf insertion oblique, subtransverse. Leaves distant, long-rectangular, mostly erect-spreading, to 0.5 mm long, 0.2–0.3 mm broad below, bifid to one-half or more, the segments long lanceolate from a 2- to 4- celled base, ending in a uniseriate 3- or 4-celled tip, the cells 3–5 times as long as broad; cells of the base of the segments 52–65 × 26 μ, the walls uniformly thickened, without trigones, the cuticle smooth. Underleaves none. Plants monoicous. Male inflorescence terminal on the stem or a long branch, the bracts in 5 or more series, leaf-like, erect, the lamina pouched, the segments spreading. Female inflorescence on a short branch, the bracts and bracteoles in 3 or 4 series, similar to the leaves, longer, the segments widely spreading to falcate. Perianth to 2 mm or more long, narrow, cylindrical below, 3-keeled above, the mouth contracted, short-ciliate.

Pl. 80. Fig. 9, a–h.

Habitat: On moist soil and logs.

COLOMBIA: Cauca: Macizo Colombiano, Valle de Las Papas, 2910 m, *Bischler 1051* (type COL); Meta: Cordillera La Macarene, *Schultes & Bell 11681* p.p. (FH).
VENEZUELA: Fed. Distr.: Cordillera Avila, *Steyermark 55630* (F).

10. Cephalozia tubulata (Hooker f. & Taylor) Trevisan, Mem. Ist. Lomb. III. **4**: 417. 1877.

Jungermannia tubulata Hooker f. & Taylor, London Jour. Bot. **3**: 463. 1844.
Metahygrobiella tubulata Schuster, in Hb; see also Nova Hedwigia **10**: 40. 1965.

Plants of small to medium size, flaccid, whitish tinged with brown or becoming light brown, ascendant in tufts or among other bryophytes; stems 1–3 cm long, with leaves 0.6–1.0 mm wide, occasionally branched, the branches lateral, of the *Frullania* type, leafy, more rarely ventral-intercalary and leafy or occasionally small-leaved; stems with the cortical cells twice as long as wide, in transverse section the cortical layer with the dorsal rows of large cells, the ventral rows small, and the medulla of large and small cells. Rhizoids colorless or brownish, from the ventral side of the stem. Line of leaf insertion subtransverse. Leaves ovate, 0.6–0.9 mm long, 0.4 mm wide at the middle, bifid to one-half their length, the segments triangular from a base 8–10 cells across, tapering to a slender apex with a tip of usually 2 cells; cells longer than broad, those of the lower part of a segment mostly 52 × 26 μ, some larger, some smaller, the walls uniformly thickened, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts in 3–6 pairs, similar to the leaves, somewhat smaller, pouched below. Female inflorescence terminal on the stem, the bracts and bracteoles in 3 or 4 series, bifid to one-half, similar to the leaves, larger. Perianth

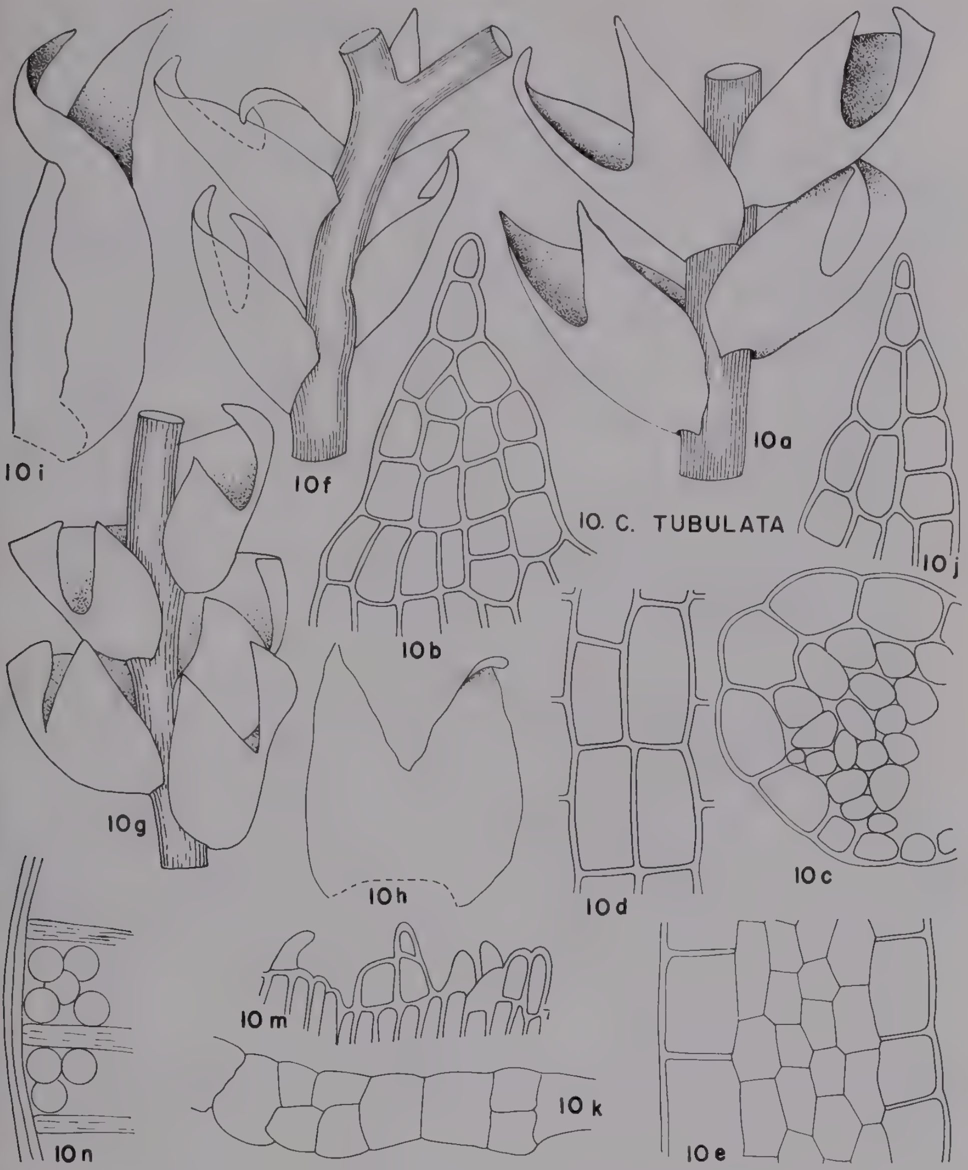

Plate 81

FIG. 10. *Cephalozia tubulata.* 10 a. Stem, dorsal view, × 50. 10 b. Leaf segment, × 200. 10 c. Portion of a transverse section of a stem, × 160. 10 d. Optical view of the dorsal portion of the stem between the two rows of leaves, × 200. 10 e. Optical view of the ventral side of the stem, × 200. 10 f. Stem, ventral view, with a branch of the *Frullania* type, × 50. 10 g. Male inflorescence, × 50. 10 h. Leaf, × 50. 10 i. Female bract, inner series, × 50. 10 j. Tip of the segment of this bract, × 200. 10 k. Portion of a transverse section of the lower part of a perianth, × 200. 10 m. Portion of mouth of perianth, × 200. 10 n. Diagram of a portion of a capsule in longitudinal section, showing the transverse arrangement of the elaters, × 200. Fig. 10 a, b, g, drawn from the type; fig. 10 c–e from *Halle 98*; fig. 10 f, from # 2, Falkland Islands; fig. 10 h–n from *Skottsberg* (G-13222).

long-exserted, cylindrical below, 3-keeled above, the mouth irregularly crenulate and setulose. Capsule with the spores and elaters arranged in more or less horizontal bands.

Pl. 81. Fig. 10, a–n.

Habitat: In pools or on low swampy ground.

PATAGONIA—TIERRA DEL FUEGO: Río Rubens, *Santesson 472* (S-PA); Punta Arenas, 600 m, *Santesson 815* (S-PA, UPS); Cerro Tesoro, *Schwabe 39* (S-PA); Pto Bueno, *Dusén* (S-PA); 190–198 k from Punta Arenas, *Fulford & Hatcher 217* p.p., *294* p.p. (Hb Fulford). Lago Fagnano, *Halle 98* (BM, S-PA); Ushuaia, *Santesson M 55* (S-PA); Pto Sicuressa, *De Gaspari 35* (FI); Río Azopardo, *Dusén 116* (S-PA, UPS); Valle Azopardo, 600 m, *Halle & Skottsberg 98* (NY, S-PA); Canal Whiteside, *Santesson M 618* (S-PA).

FALKLAND ISLANDS: Port Louis (♀), without coll. (BM); s.l., *Hooker* (isotypes BM, NY, S-PA); s.l. or without coll. [2] (BM), Hb Lehmann (BM), Hb Wilson (BM); Pt Stanley, *Skottsberg* (S-PA), s.l., *Skottsberg* (G-13222).

11. **Cephalozia physocaula** (Hooker f. & Taylor) Stephani, Spec. Hep. **3**: 315. 1908.

Jungermannia (*Gymnomitrium*) *physocaula* Hooker f. & Taylor, London Jour. Bot. **3**: 455. 1844.
Acolea physocaula Massalongo, Nuovo Giorn. Bot. Ital. **17**: 263. 1885.
Cesiusa physocaula (T. Taylor) O. Kuntze, Rev. Gen. Plant. **2**: 834. 1891.
Cephalozia amplexicaulis Stephani, Spec. Hep. **3**: 333. 1908.
Cephaloziella amplexicaulis Stephani, Icon. Hep. *Cephaloziella, no. 12.*
Metahygrobiella physocaulon Schuster, in Hb.; see also Nova Hedwigia **10**: 40. 1965.

Plants slender, whitish becoming light or dark brown, appearing complanate, over other bryophytes; stems 1–2.5 cm long, with leaves to 0.6 mm broad, irregularly branched; branches of the *Frullania* type or rarely intercalary; cortical cells of the stem large, rectangular in outline. Rhizoids not seen. Line of leaf insertion transverse. Leaves ascendant, imbricate, deeply concave to folded with a rounded or angled keel, symmetric, ovate, cordate at both bases, bifid to one-half the length, the segments broadly triangular from a base 7 to 12 cells wide, the apex acute, ending in a 1-celled tip; cells quadrate to rectangular in outline, those near the base of a segment 30–42 × 26–30 μ, the walls uniformly thick, the cuticle verruculose. Underleaves absent. Male and female inflorescences not seen.

Pl. 82. Fig. 11, a–f.

Habitat: Unknown.

PATAGONIA—TIERRA DEL FUEGO: Desolation Island, Pto Angosto, *Dusén 185*, type of *C. amplexicaulis* (G, UPS). Hermite Island, *Hooker* (type BM, NY, S-PA); Ushuaia, 245 m, *Skottsberg* (S-PA); Staten Island: Pt Cook, *Skottsberg* (S-PA).

12. **Cephalozia badia** (Gottsche) Stephani, Spec. Hep. **3**: 313. 1908.

Jungermannia badia Gottsche, Die Deutsch. Exped. Ergebnisse **2**: [separate p. 6]. *pl. 1, f. 1–5.* 1890.

Plants small, slender, flaccid, whitish becoming brown in the outer parts; stems to 1.5 cm long, irregularly branched, the branches of the *Frullania* type, leafy, occasionally ventral-intercalary with small leaves; cortical cells of the stem rectangular, the dorsal rows large, the ventral rows (2) smaller. Rhizoids from the ventral side of the stem, hyaline or brownish. Line of leaf insertion oblique, subtransverse. Leaves distant, irregularly spreading with the segments usually incurved, ovate, bifid to one-third the length, the segments triangular from a base usually 8 cells wide, the tip of 1 cell; cells of the segment quadrate in outline with a few cells rectangular,

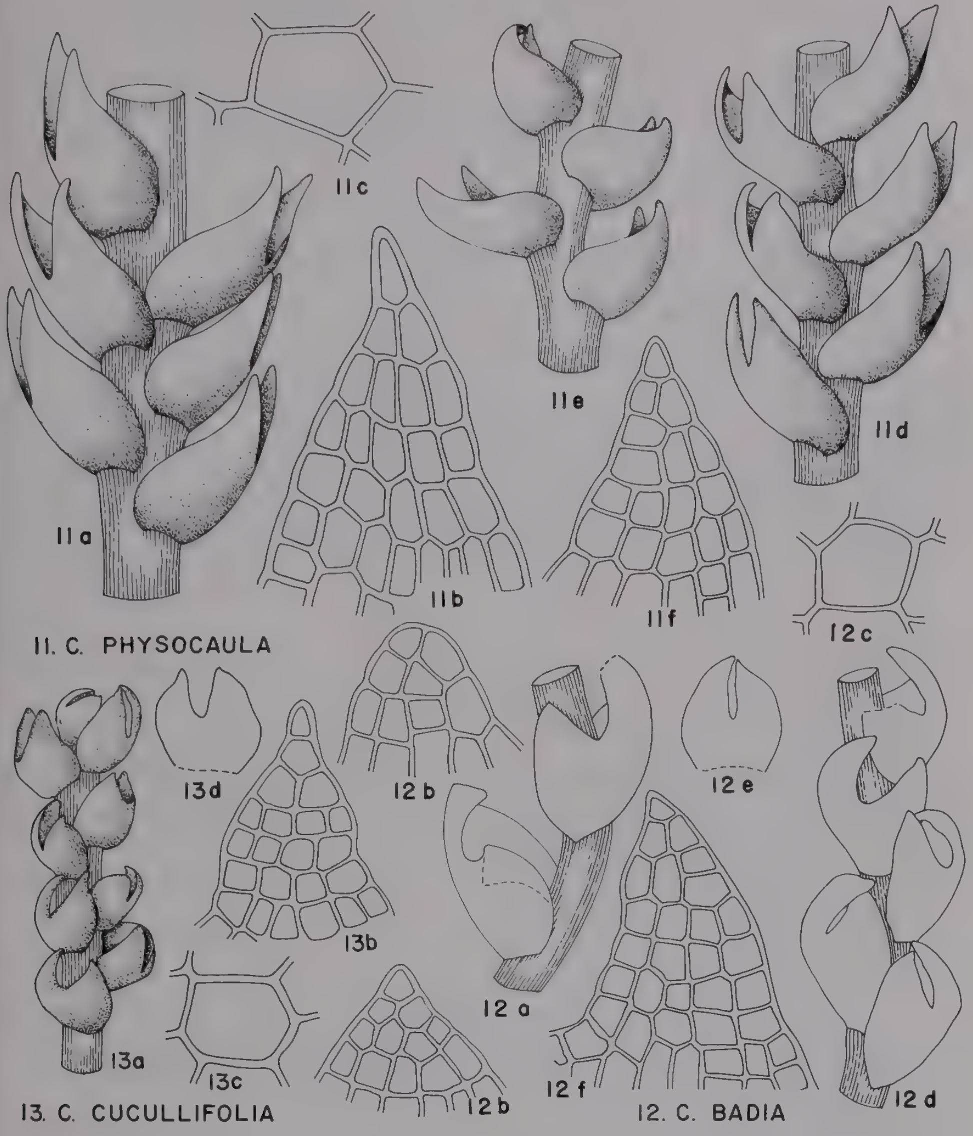
11c
11e
11d
11a
11b
11f
12c
11. C. PHYSOCAULA
13d
12b
12e
13b
12a
13a
13c
12b
12f
12d
13. C. CUCULLIFOLIA
12. C. BADIA

Plate 82

FIG. 11. *Cephalozia physocaula*. 11 a. Stem, dorsal view, × 50. 11 b. Segment of a leaf, × 200. 11 c. Cell from the lower part of a segment, × 500. 11 d. Stem, dorsal view, × 50. 11 e. Stem, ventral view, × 50. 11 f. Segment of a leaf, × 200. Fig. 11 a–c, drawn from the type; fig. 11 d–f, from the type of *C. amplexicaulis*.

FIG. 12. *C. badia*. 12 a. Stem, dorsal view, × 50. 12 b. Tip of a leaf segment, × 200. 12 c. Cell from the lower part of a segment, × 500. 12 d. Stem, dorsal view, × 50. 12 e. Leaf, × 50. 12 f. Segment of a leaf, × 200. Fig. 12 a–c, drawn from the type; fig. 12 d, from *Halle 99*; fig. 12 e, f, from *Skottsberg 99*.

FIG. 13. *C. cucullifolia*. 13 a. Stem, dorsal view, × 50. 13 b. Segment of a leaf, × 200. 13 c. Cell from the lower part of a segment, × 200. 13 d. Leaf, × 50. Drawn from the type.

those of the lower part mostly 26 × 26 μ, the walls uniformly thickened, the cuticle verruculose. Underleaves none. Male and female inflorescences not seen.

Pl. 82. Fig. 12, a–f.

Habitat: In wet places.

PATAGONIA—TIERRA DEL FUEGO: Lago Fagnano, *Halle 99* (BM, UPS).

SOUTH GEORGIA: s.l., *Will* (type G); German Venus Exp., without coll. (BM); Cumberland Bay, *Skottsberg 99* (UPS).

FALKLAND ISLANDS: s.l. or without coll. (S-PA).

13. Cephalozia cucullifolia Stephani, Wiss. Ergeb. Schwed. Sudpolar-Exped. 1901–1903. **41**: 2. 1905.

Cephaloziella cucullifolia Stephani, Icon. Hep. *Cephaloziella, no. 13.*

Stems minute, slender, thread-like, whitish becoming brownish to deep brown, among other bryophytes; stems to 1 cm long, often becoming small-leaved flagelliform at the tips, the occasional branches of the *Frullania* type or ventral-intercalary. Rhizoids not seen. Line of leaf insertion oblique, subtransverse. Leaves more or less rounded, cup-shaped, bifid to one-half, the sinus narrow, the leaf segments incurved, triangular from a base 7 or 8 cells across, acute; cells of the segment mostly quadrifid in outline, 26–30 × 26 μ, the walls uniformly thickened, the cuticle verruculose. Underleaves none. Male and female inflorescences not seen.

Pl. 82. Fig. 13, a–d.

Habitat: Swampy ground over other bryophytes.

SOUTH SHETLAND ISLANDS: Nelson Island, Harmony Cove, *Skottsberg 400* (type G-13202).

SOUTH ORKNEY ISLANDS: [*Slader*], *612/9*, *612/10*, *619/7* p.p. (UPS).

The following species of *Cephalozia*, reported from Latin America, have not been studied.

C. armata Stephani, 1924. Mexico.
C. crossii Spruce, 1882. Colombia.
C. densa Pearson, 1931. Jamaica.
C. diacantha (Montagne) Stephani.
  Jungermannia diacantha Montagne, 1856. Peru.
C. filum (Nees) Trevisan.
  J. filum Nees, 1844. Peru.
C. grandiretis Stephani, 1924. Peru.
C. micromera Spruce, 1882. Brazil. = *Paracromastigum* fide Schuster.
C. patentiloba Stephani, 1924. Ecuador. [*Allioni 708.*]
C. pygmaea Spruce, 1882. Peru.
C. pygmaea var. *spinuliflora* Spruce. Brazil.
C. skottsbergii Stephani, 1905. South Georgia: Cumberland Bay.
C. subtilis (Lindenberg & Gottsche) Stephani, 1908.
  J. subtilis Lindenberg & Gottsche. Mexico.

Reference

Schuster, R. M. 1964. Studies on Hepaticae. XXI. Cephaloziaceae, with particular reference to *Metahygrobiella* Schust. and *Cephalozia* Dumort. Nova Hedwigia **8**: 211–223. 1964.

Nowellia Mitten in Godman, Nat. Hist. Azores 321. 1870.

Cephalozia Dumortier, Recueil Obs. Jungerm. 18. 1835.

Plants of small to medium size, chain-form, whitish-green, yellow-green to red or rose-purple, prostrate, in mats or creeping among other bryophytes. Stems 1–2 cm long, with leaves 0.3–0.8 mm wide, occasionally branched; branches lateral, of the *Frullania* type, or ventral-intercalary, leafy, the ventral branches sometimes short bearing a female inflorescence; stem in transverse section with a cortical layer of 6–8 rows of large thick-walled cells surrounding about 6 smaller cells. Rhizoids from the ventral surface of the stem and the lower part of the female inflorescence. Line of leaf insertion short, nearly transverse. Leaves bilobed, the segments triangular, ending in a short to long uniseriate, capillary point, dorsal margin of the lamina convex from a straight base, entire or with several teeth, the sinus broad V-shaped to lunulate, entire or with several teeth, the ventral margin with a large inrolled inflated sac. Underleaves absent. Plants monoicous or dioicous. Male inflorescence terminal becoming intercalary on the stem or a branch, the bracts bifid, without a ventral sac, bracteoles absent. Female inflorescence on a very short ventral-intercalary branch, the bracts and bracteoles long-ovate, keeled, bifid, serrate. Perianth long, 3-keeled above, the mouth broad, crenulate, toothed or short-ciliate. Shoot-sporophyte relationship a shoot-calyptra. Capsule brownish, ovoid, the wall 2-layered, with characteristic wall thickenings; seta in transverse section of 8 large outer cells surrounding 4 inner cells. Spores light brown. Sporeling protonema filamentous, of the *Cephalozia* type. Gemmae 1-celled, in chains from the tips of leaves.

Type species: *Jungermannia curvifolia* Dickson, 1790.

Key to the Species

1. Dorsal margin and sinus of the leaf entire, without projections.
    2. Leaf segments short, the tip only a few cells (1–3) long. 2. *N. yunckeri.*
    2. Leaf segments long, the tip 4–7 cells long.
        3. Cells of the segments mostly subquadrate; sinus bordered by similar cells. 1. *N. curvifolia.*
        3. Cells of the segment mostly long-rectangular; sinus bordered by 1 or 2 rows of similar long cells parallel to the margin. 3. *N. caribbeania.*
1. Dorsal margin and sinus of the leaf spinose or toothed.
    2. Spines numerous, sharp, long, mostly 2-celled. 5. *N. wrightii.*
    2. Teeth few, of one blunt cell. 4. *N. bicornis.*

1. Nowellia curvifolia (Dickson) Mitten in Godman, Nat. Hist. Azores 321. 1870.

Jungermannia curvifolia Dickson, Pl. Crypt. Fasc. **2**: 15. 1790.
Jungermannia Baueri Martius, Fl.Crypt. Erlangensis 172. 1817.
Cephalozia curvifolia Dumortier, Recueil Obs. Jungerm. 18. 1835.
Trigonanthus curvifolius Spruce in Hartman, Skand. Bl. ed. X. 143. 1871.

Plants small, chain-like, whitish-green of yellow-green becoming red or rosy purple, in mats or creeping among other bryophytes. Stems slender, 1–2 cm long, with leaves to 0.4 mm wide, occasionally branched; branches lateral, of the *Frullania* type or ventral-intercalary, leafy, the ventral branches often short, bearing a female inflorescence. Rhizoids long, slender, colorless, from cells of the ventral side of the stem. Line of leaf insertion short, nearly transverse. Leaves broadly obovate, bilobed to one-half their length, concave with the outer part curved upward, imbricate, the segments long-triangular from a base 5–8 cells wide and ending in as erect or curved, uniseriate 5- to 7-celled tip, the dorsal margin convex from a straight base, the ventral margin with a large sac, the sinus usually broad V-shaped; cells of the leaf tip 30–39 × 13–20 μ, cells of the segment mostly quadrate, 20–25 μ, rarely to 30 × 20–25 μ, the walls uniformly thickened, without distinct trigones, the cuticle essentially smooth. Underleaves absent. Plants monoicous and dioicous. Male in-

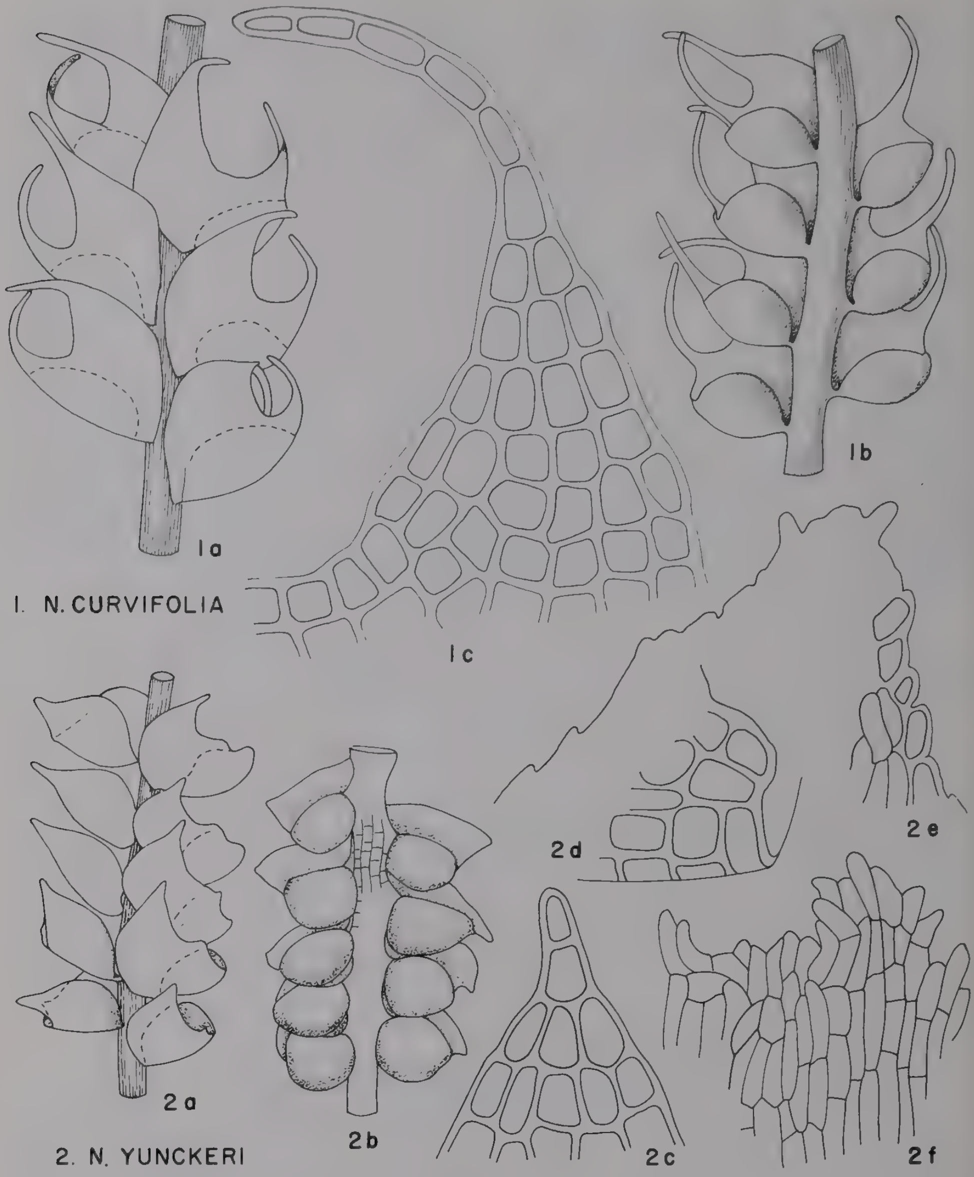

Plate 83

FIG. 1. *Nowellia curvifolia.* 1 a. Stem, dorsal view, × 50. 1 b. Stem, ventral view, × 50. 1 c. Dorsal leaf segment, × 275. Drawn from *Sharp 2077*, Guatemala.

FIG. 2. *N. yunckeri.* 2 a. Stem, dorsal view, × 50. 2 b. Stem, ventral view, × 50. 2 c. Dorsal leaf segment, × 275. 2 d. Ventral leaf segment, × 275. 2 e. Segment from an inner female bract, × 200. 2 f. Portion of the perianth mouth, × 200. Drawn from the type.

florescence terminal often becoming intercalary on a stem, long, the bracts in many series, equally bifid, without a sac on the ventral margin and without the long, capillary leaf-tips. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, long-ovate, keeled, bifid, the margins serrate. Perianth long, 3-keeled above, the mouth broad, truncate, spinose and short-ciliate. Gemmae spherical from the tips of leaves, rare.

Pl. 83. Fig. 1, a–c.

Habitat: On decayed logs, tree trunks or more rarely on soil banks.

MEXICO: Chiapas: Mapastepec, *Sharp 4576*, *4702A* p.p. (TENN); Hildago: Chapatla, 6200 ft, *Sharp 5659* (TENN); Puebla: w of Huauchinango, *Sharp 991* (TENN).

GUATEMALA: Baja Verapaz: near Jicaro, 4600 ft, *Sharp 2689* p.p. (TENN), near Finca Bucaral, 6000 ft, *Sharp 2784* (TENN), Civija, 4000 ft, *Sharp 5167* p.p. (TENN). El Progreso: above Morazán, 4300 ft, *Sharp 5097* (TENN), near Finca Piamonte, 2400–2500 m, *Steyermark 43434* (F). El Quechi, above Nebaj, 8500 ft, *Sharp 2527* (♀) (TENN). San Juan Ixcoy: Huehuetenango, 8800 ft, *Sharp 4988* p.p. (TENN). Quezaltenango: Totonicapán, 3100–3200 m, *Standley 84549* (F), above Chiquival, 7700 ft, *Sharp 2076*, *2077* (TENN).

2. **Nowellia yunckeri** Fulford, sp. nov.

Caules parvi, subtiles, subvirides, 1–2 cm longi; folia impariter biloba, segmento dorsali late triangulari, acuto, segmento ventrali paucis cellulis; sacculo magno, inflato, orbiculato. Amphigastria obsoleta. Perianthii os irregulariter crenulatum.

Plants small, coarse thread-like, dull green often becoming brownish red, in dense mats or creeping among other bryophytes. Stems 1–2 cm long, with leaves to 0.6 mm wide, rarely branched: branches lateral, of the *Frullania* type, and ventral-intercalary, leafy, the ventral branches often short, bearing a female inflorescence. Rhizoids long, from cells of the ventral side of the stem. Line of leaf insertion short, nearly transverse. Leaves concave, spreading, ascendant, imbricate, broadly orbicular, shortly bilobed, the dorsal segment broadly triangular from a 5- to 8-celled base, ending in a 2- to 4-celled tip, the ventral segment a blunt tooth of only one or a few cells, the sac large, to half the size of the leaf, inflated, widely spreading or slightly ascendant; cells of the lower part of the dorsal segment mostly quadrate in outline, $26 \times 20–26\ \mu$, the walls uniformly thickened, the cuticle essentially smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on a stem or branch, long or short, the bracts equally bifid. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, long-ovate, keeled, bifid, the margins irregularly crenulate. Perianth long, 3-keeled above, the mouth wide, irregularly truncate, crenulate.

Pl. 83. Fig. 2, a–f.

Habitat: In dense mats on moist soil bank and on stones in a stream.

HONDURAS: near Siguatepeque, *Yuncker 6527* (type DPU); near El Achote, *Yuncker 6408* (DPU); s.l., *Standley 56211* (F).

3. **Nowellia caribbeania** Fulford, sp. nov.

Caules longi, graciles, subtiles, albidi rubro suffusi; folia profunde bifida, segmentis aequalibus, longis, apice uniseriata e 4–5 cellulis constato, conniventibus, margine sinus e duabus seriebus cellulorum longe rectangularium constato, sacculo parvo, inflato, oblongo. Amphigastria obsoleta.

Plants of small to medium size, chain-like, whitish-green becoming tan to rosy purple, in dense mats or creeping among other bryophytes; stems to 2 cm or more long, with leaves to 5 mm wide, appearing to be compressed laterally, occasionally branched; branches lateral, of the *Frullania* type and ventral-intercalary, leafy, the ventral branches often short and bearing a female inflorescence. Rhizoids abundant from cells of the ventral side of the stem, rather broad, whitish. Line of leaf insertion short, nearly transverse. Leaves broadly ovate from a narrow base, concave, widely

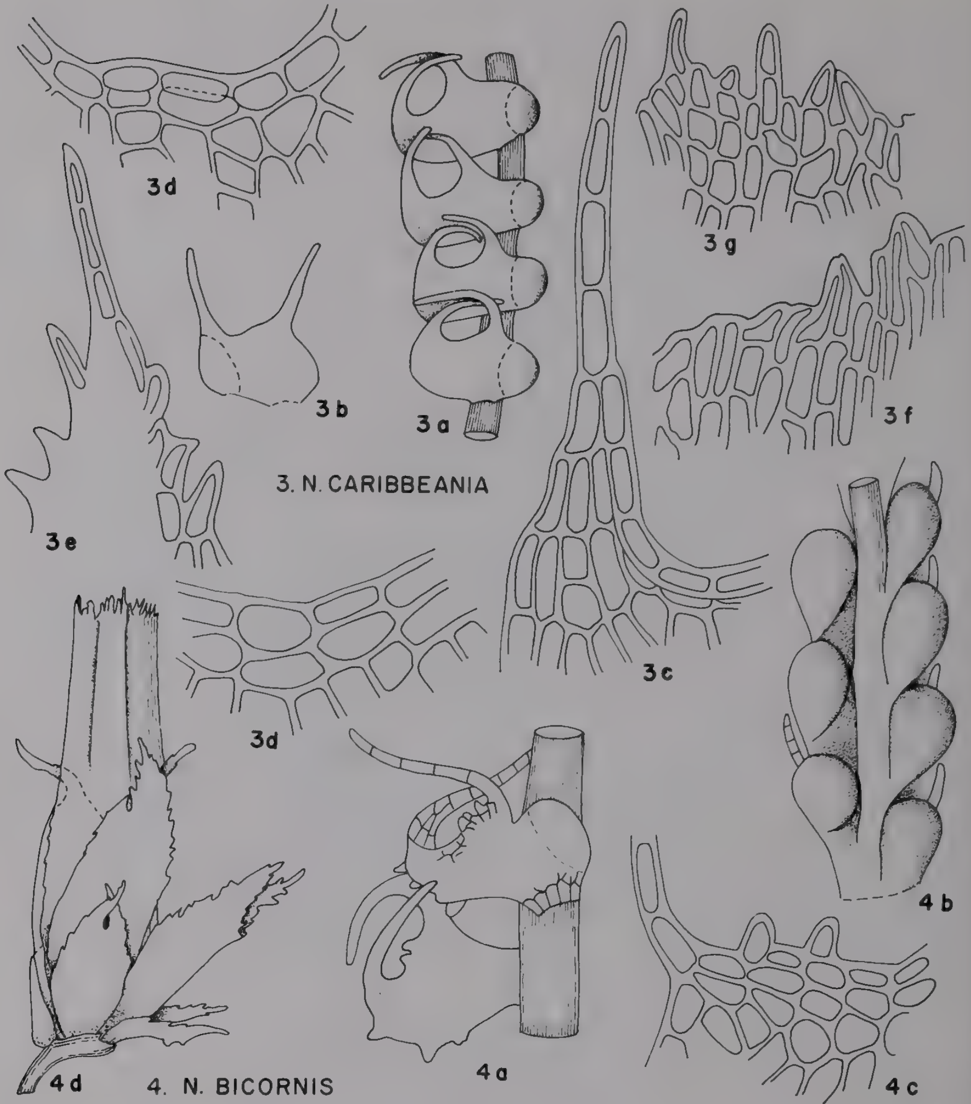

Plate 84

FIG. 3. *Nowellia caribbeania.* 3 a. Stem, lateral view, × 50. 3 b. Leaf, × 50. 3 c. Dorsal leaf segment, × 275. 3 d. Leaf sinus, × 275. 3 e. Segment tip of a female bract, innermost series, × 200. 3 f. Portion of a perianth mouth, × 275. 3 g. Portion of a perianth mouth (young), × 275. Fig. 3 a–f, drawn from the type; 3 g, from a plant from Costa Rica.

FIG. 4. *N. bicornis.* 4 a. Stem, lateral view, × 95. 4 b. Stem, ventral view, × 95. 4 c. Leaf sinus, × 280. 4 d. Female inflorescence and perianth, × 27. After Spruce, 1895

spreading with the outer part curved upward, imbricate, bifid to one-half, the segments long, triangular from a 4- to 6-celled base, ending in a capillary tip 4–7 cells long, the tips weakly connivent to overlapping, the ventral sac rather small, protruding as a knob beyond the stem, the sinus broad-lunulate, bordered at least in part, by 1 or 2 rows of rectangular cells; cells of the tip 35–40 × 15–20 μ, cells of the lower part of the segment mostly 30–39 × 15–20 μ, the walls uniformly thickened, the cuticle essentially smooth. Underleaves absent. Plants dioicous. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, long ovate, more or less keeled, bifid above, the segments acute, the margins spinose from projecting cells. Perianth long, 3-keeled above, the mouth broad, truncate, irregularly short-ciliate and crenulate. [The cilia may disappear later.] Male inflorescence not seen.

Pl. 84. Fig. 3, a–g.

Habitat: In dense mats over decayed logs, on trunks of trees and at higher elevations, on sandstone.

JAMAICA: s.l., *Underwood 1230* (Y).

GUATEMALA: Alta Verapaz, road to Tamahú, 1500–1600 m, *Standley 91494* (F).

HONDURAS: Morazán: Piedra Herrada, Cerro de Uyuca, 1500–1650 m, *Standley 4885, 11,896* (F).

COSTA RICA: s of El Palme, *Little 5637* (Hb Little).

VENEZUELA: Aragua: Choroní Pass, 1130 m, *Fulford & Steyermark 1172* (Hb Fulford). Amazonas: summit of Cerro Duida, *Steyermark 58381, 58383* p.p. (F). Bolívar: Río Venamo, 950 m, *Steyermark 92216, 92231* (type), *92235* p.p. (VEN), the same, 1000 m, *Steyermark 92278* (VEN).

4. **Nowellia bicornis** (Spruce) Fulford, comb. nov.

Cephalozia wrightii var. *bicornis* Spruce, Jour. Linn. Soc. Bot. **30**: 354. *tab. 26, f. 1–4.* 1895.

Plants small, delicate, pale green to reddish, in mats or creeping among other bryophytes. Stem 1–2 cm long, with leaves 0.3–0.4 mm wide, rarely branched; branches lateral of the *Frullania* type, or ventral-intercalary, leafy, the ventral branch often bearing a female inflorescence. Rhizoids long, from cells of the ventral side of the stem. Line of leaf insertion very short, nearly transverse. Leaves widely spreading with the outer part turned upward or incurved, subimbricate, concave, bilobed to one-half their length, the dorsal segment long triangular from a few-celled base, ending in a capillary tip of 4–6 cells, the ventral segment scarcely more than a row of 4–6 cells, the tips often connivent or folded across each other, the dorsal margin convex bearing one to several 1-celled teeth, the lunulate sinus bordered by rectangular cells and bearing 1 or 2 teeth, the ventral sac rounded, extending beyond the stem; cells of the capillary tip, about 40 × 20 μ, those of the base of the segment 30–40 × 20 μ, the walls uniformly thickened, the cuticle smooth. Underleaves absent. Monoicous and dioicous. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, long ovate, keeled, bifid above, the segments acuminate, the margin denticulate below, variously spinose above. Perianth long, 3-keeled above, the mouth broad, truncate, setose and short-ciliate. Male inflorescence not seen.

Pl. 84. Fig. 4, a–d.

Habitat: In mats on decayed logs.

PUERTO RICO: Luquillo Mountains; Pico del Oeste, *Steere 5948* (Hb Fulford), *Fulford, Crandall & Stotler 452* p.p. (Hb Fulford).

DOMINICA: s.l., *Elliott 886* (type, cited by Spruce, 1895).

5. **Nowellia wrightii** (Gottsche ex Spruce) Stephani in Duss, Fl. Crypt. Antill. 149. 1904.

Cephalozia wrightii, Gottsche ex Spruce, Jour. Linn. Soc. Bot. **30**: 354. 1895.

Plants small, delicate, whitish to light green becoming tinged with red, in dense

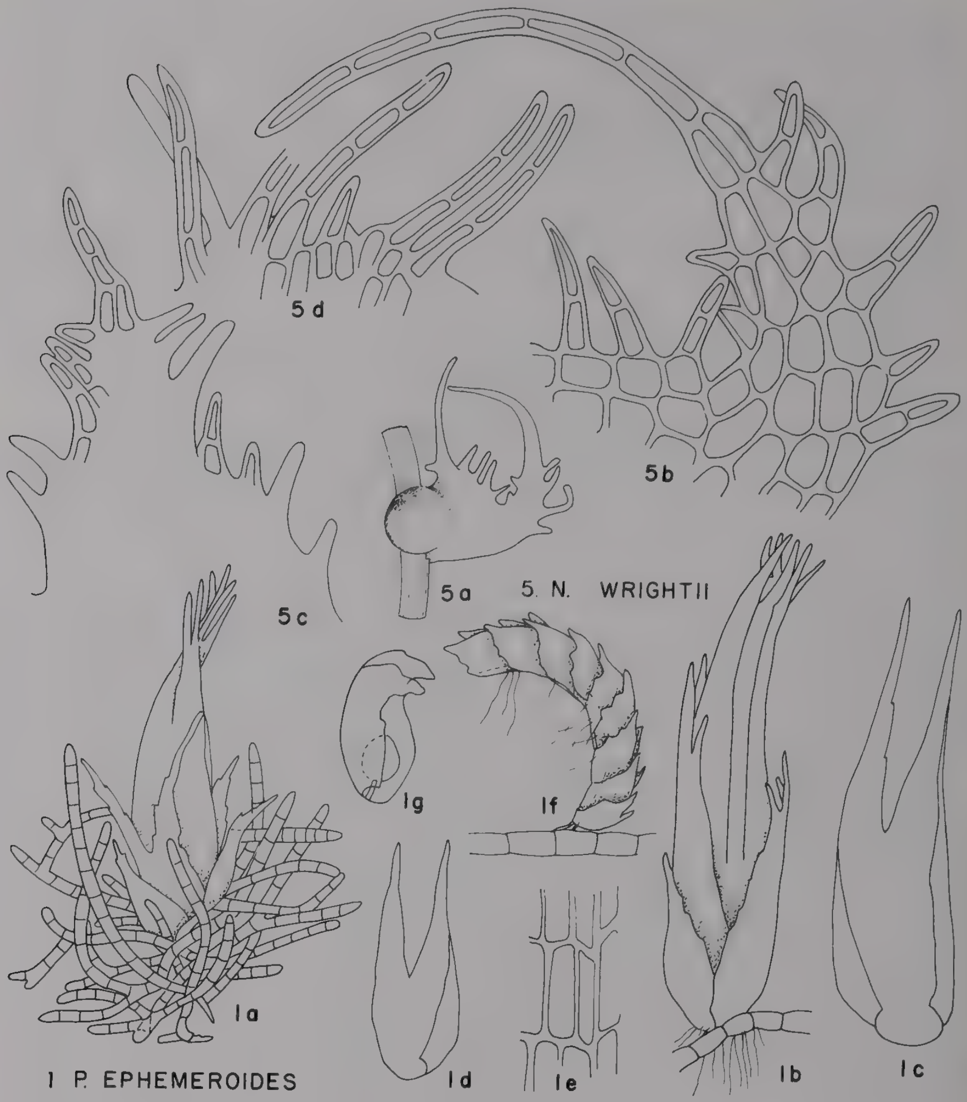

Plate 85

FIG. 5. *Nowellia wrightii.* 5 a. Leaf on a stem, ventral view, × 70. 5 b. Leaf segment, × 275. 5 c. Segment from a female bract of the innermost series, × 200. 5 d. Portion of a perianth mouth, × 275. Drawn from an isotype (NY).

FIG. 1. ***Protocephalozia ephemeroides.*** 1 a. Vegetative plant and perianth. 1 b. Female inflorescence and perianth. 1 c. Female bract of the inner series. 1 d. Female bracteole. 1 e. Cells of the female bract. 1 f. Male inflorescence. 1 g. Male bract and antheridium. After Spruce, 1885.

mats or creeping among other bryophytes; stems 1–2 cm long, with leaves, to 0.4 mm wide, appearing laterally compressed; branches occasional, lateral and of the *Frullania* type or more frequently ventral-intercalary, leafy, bearing a female inflorescence. Rhizoids long, colorless, from cells of the ventral side of the stem. Line of leaf insertion very short, nearly transverse. Leaves spreading, concave, the outer part incurved, subimbricate, bilobed to one-half their length, the dorsal segment long triangular from a 3- to 4-celled base, ciliate, capillary, ending in a row of 4–6 cells, the ventral segment usually a row of 5 or 6 cells, the segments connivent, often overlapping, the sinus lunulate, the margin with two or three 2-celled cilia, the ventral sac rounded, extending beyond the stem; cells of the segment tips 40–50 × 15 μ, of the segment base 25, 35–40 × 15–20 μ, the walls uniformly thickened, the cuticle essentially smooth. Underleaves absent. Female inflorescence on a short ventral branch, the bracts and bracteoles in three series, long-ovate, keeled, bilobed above, the segments acute, the margins setulose and ciliate with 2-celled cilia. Perianth long, 3-keeled above, the mouth not contracted, truncate, setulose and ciliate with 3-celled cilia. Male inflorescence not seen.

Pl. 85. Fig. 5, a–d.

Habitat: In mats on decayed logs or among other bryophytes.

CUBA: s.l., *Wright, Hep. Cub. Wright.* (isotypes NY, Y). Oriente: Sierra Maestra, *Ekman 7115* p.p. (S-PA, UPS).

DOMINICA: Morne Trois Pitons, 4500 ft, *Elliott 2300* (BM).

GUADELOUPE: bois des Baines-Jaunes, 800 m, *Duss 118* (BM); *Allorge & Allorge* (PC).

Reference

Fulford, M. 1955. The patterns of development of sporelings, gemmalings, and regenerants in *Nowellia curvifolia* (Dicks.) Mitten. Revue Bryol. & Lichénol. **24**: 41–48. 27 figs. 1955.

Protocephalozia (Spruce) Schiffner in Engler & Prantl, Nat. Pflanzenf. **1**^{3}: 96. 1893.

Cephalozia subg. I. *Proto-Cephalozia* Spruce, On *Cephalozia* 24, 1882.

Vegetative plant small, light green, branched-filamentous (a prolonged persistent protonema from a *Cephalozia*-type sporeling) suggesting the protonemata of certain mosses; filaments uniseriate, rarely 2 cells wide near the base. Rhizoids absent. Plants monoicous or dioicous, the inflorescences foliaceous. Male inflorescence terminal or lateral, the long curved branch with to 10 series of bracts, with rhizoids scattered over the ventral side of the axis; bracteoles absent. Antheridial stalk uniseriate. Female inflorescence never terminal on a filament, rhizoids abundant at the base, the bracts and bracteoles tristichous, in 2 or 3 series, the inner series longest, long-ovate, bifid to one-half their length. Perianth long, 3-keeled above, the mouth of 6 long slender segments similar to those of the bracts and bracteoles. Shoot-sporophyte relationship a shoot/calyptra. Capsule small, dark, oblong in outline, the wall of 2 layers with characteristic markings; seta in transverse sections mostly 4 cells across, an outer layer of 8 rows and an inner core of 4 cells.

Type species: *Cephalozia* (*Proto-Cephalozia*) *ephemeroides* Spruce, 1882.

Protocephalozia ephemeroides (Spruce) Schiffner in Engler & Prantl, Nat. Pflanzenf. **1**^{3}: 96. 1893.

Cephalozia ephemeroides Spruce, On *Cephalozia* 24. 1882.

Vegetative plants in small, light green, much branched filamentous mats; filaments uniseriate, the cells rectangular in outline, the cuticle papillose. Rhizoids absent except on the male and female branches. Plants monoicous or dioicous. Male inflorescence terminal or lateral on a filament, the long curved branch bearing to 10 series of male bracts, with scattered rhizoids along the ventral side; bracts small, imbricate, broadly ovate, concave, more or less folded, bifid to one-third their length, the segments broadly triangular, curved, the margins incised, monandrous; antheridial stalk uniseriate. Female inflorescence lateral on a filament, with numerous rhizoids from the base, the bracts and bracteoles tristichous, in 2 or 3 series, the inner series largest, long-ovate, bifid to one-half their length, the segments triangular, with coarse marginal teeth. Perianth long, 3-keeled in the upper half, the mouth of 6 long slender triangular segments. Capsule small, dark, 0.3 × 0.18 mm oblong in outline. Seta in transverse sections of 4 rows of inner cells surrounded by 8 rows of outer cells of similar size. [Spruce, 1885.]

Pl. 85. Fig. 1, a–g.

Habitat: On soil in woods.

BRAZIL: S. Carlos et Catanacunámi, *Spruce, Hep. Spruc.* (isotype NY).

ODONTOSCHISMACEAE K. Müller in Rabenhorst, Krypt. Fl. Erganzungsband. **6**^{2}: 184. 1939.

Cephaloziaceae subfam. Odontoschismoideae Buch, Suomen Maksammalet 21. 1934.
Cephaloziaceae auct. p.p.

Sporeling of the *Nardia* type, i.e., the protonema a mass (often cylindrical) of cells formed outside the exospore. Leafy stems often from stolon-like flagelliform branches, irregularly branched, the branches lateral of the *Frullania* type, or more characteristically, ventral-intercalary (in *Anomoclada* also dorsilateral intercalary), leafy or flagelliform stolon-like or short sexual. Rhizoids from the ventral side of the stem. Leaves succubous, ovate, orbicular or subrectangular, or in *Cladopodiella*, divided to the middle into 2 oblong segments. Underleaves small, often of only a few cells. Male inflorescence usually ventral-intercalary, more rarely terminal becoming intercalary on the stem, both bracts and bracteoles present; antheridia in the axils of the bracts. Female inflorescence terminal on the stem or on a short ventral sexual branch, the bracts and bracteoles in 3 or 4 series, the inner series largest, bifid. Perianth cylindrical below, 3-keeled above.

Type genus: *Odontoschisma* Dumortier, 1835.

Key to the Genera

1. Leaves divided to one-half, the 2 segments oblong with broad rounded tips; plants very small, light green, fragile. *Cladopodiella.*
1. Leaves undivided; plants small to large, whitish, green, brown or reddish to purple.
   2. Plants small, delicate, whitish or tinged with red; leaves of about 50 cells or less, ovate with blunt apices. *Alobiellopsis.*
   2. Plants small or large, coarse, whitish, green, brown or tinged with red; leaves broadly rounded, ovate, oblong or rectangular.
      3. Leaves with crisped-undulate margins; leaf cells very large with knot-like trigones; branches often dorsilateral, intercalary. *Anomoclada.*
      3. Leaf margins never crisped-undulate; leaf cells large or small, the trigones tiny to large and knot-like. *Odontoschisma.*

Odontoschisma Dumortier, Recueil Obs. Jungerm. 19. 1835.

Pleuroschisma sect. *Odontoschisma* Dumortier, Syll. Jungerm. 68. 1831.
Sphagnoecetis Nees in G. L. & N. Syn. Hep. 148. 1845.
Cephalozia subg. *Odontoschisma* Spruce, On *Cephalozia* 59. 1882.

Plant, delicate to large and coarse, whitish, light to dark green, yellow-brown or red to purple, caespitose or among other bryophytes. Stems prostrate, sometimes becoming flagelliform, or erect radial, small-leaved, gemmiparous; branches ventral-intercalary, leafy, flagelliform (stolon-like) or short sexual; stem in transverse section

6–12 cells in diam, the cortical layer of many rows of cells usually little different from the cells of the medulla. Rhizoids from cells along the ventral side of the stem. Line of leaf insertion oblique, sometimes nearly longitudinal, the leaves succubous. Leaves orbicular to ovate, undivided or rarely emarginate, the margin plane or upcurved, the cells uniformly thin-walled or with small or large trigones separated by thin-walled pits, the marginal cells sometimes different and forming a border. Underleaves scale-like, few-celled. Plants dioicous. Male inflorescence a bud- or catkin-like ventral branch. Female inflorescence on a short ventral branch, the bracts in 3 or 4 series, bifid. Perianth long, 3-keeled above, the mouth contracted, the 3 lobes crenulate, setulose or short or long ciliate. Capsule oval, brown, the wall of 2 layers of cells with characteristic markings. Gemmae 2-celled, thin-walled, green or red, borne at the tips of small-leaved erect shoots.

Type: *Jungermannia sphagni* Dickson, 1785.

Key to the Species

1. Leaf cells with small or tiny trigones with concave sides.
    2. Leaves narrow-rectangular, plane, the marginal leaf cells 15–20 μ; plants whitish. 4. *O. soratamum.*
    2. Leaves broad-rectangular to long-orbicular; plants light green, yellow-brown or reddish.
        3. Leaves plane, the marginal cells 15 × 15 μ, with thicker walls than the rest. 1. *O. longiflorum.*
        3. Leaves concave, with an upturned margin of 1–3 rows of cells.
            4. Leafy stems arising singly from the rhizome; marginal leaf cells 13–20 μ, with uniformly thickened walls. 2. *O. prostratum.*
            4. Leafy stems arising in tufts from a leafless stolon; marginal leaf-cells mostly 20 × 20 μ. 3. *O. stoloniferum.*
1. Leaf cells with large, rounded or knot-like trigones.
    2. Plants tiny, deep red or purple, often curved; leaves rounded, trigones very large. 10. *O. atropurpureum.*
    2. Plants larger, the leaves mostly longer than broad; green, yellow-brown or tinged with red.
        3. Leaves plane; marginal cells large, rectangular with a thick outer wall; upper leaf cells to 26 μ or larger; trigones very large.
            4. Leaf margin undulate and crisped. see *Anomoclada.* p. 346
            4. Leaf margin straight. 9. *O. falcifolium.*
        3. Leaves concave with a more or less upturned margin.
            4. Cells of the border large, 26–30 μ, the outer wall very thick, the cell lumina angular. 8. *O. brasiliense.*
            4. Cells of the border mostly less than 20 μ, the walls thickened, the trigones conspicuous.
                5. Leaves broad ovate-cordate, the dorsal part recurved. 7. *O. cordifolium.*
                5. Leaves ovate to orbicular, the leaf not folded.
                    6. Cells of the upper part of the leaf mostly 20–24 μ in diam; trigones large, the cell cavities stellate 6. *O. denudatum.*
                    6. Cells of the upper part of the leaf larger, 26–30 μ in diam; the trigones knot-like, separated by thin cell walls. 5. *O. variabile.*

1. **Odontoschisma longiflorum** (Taylor) Stephani, Spec. Hep. **3**: 370. 1908.

Sphagnoecetis longiflora Taylor, London Jour. Bot. **5**: 281. 1846.
Odontoschisma sphagni var. Spruce, Rev. Bryol. **15**: 33. 1888. [*Glaziou no. 7231.*]
Odontoschisma planifolium Stephani, Spec. Hep. **3**: 370. 1908.
Odontoschisma glaziovii Stephani, Spec. Hep. **3**: 372. 1908. [*Glaziou no. 7231.*]

Plants light or pale green, rarely tinged with red near the tips, prostrate, occasionally becoming erect, small-leaved and gemmiparous, in mats or among other bryophytes; stems 1–2 cm long, with leaves to 2 mm wide, more or less frequently

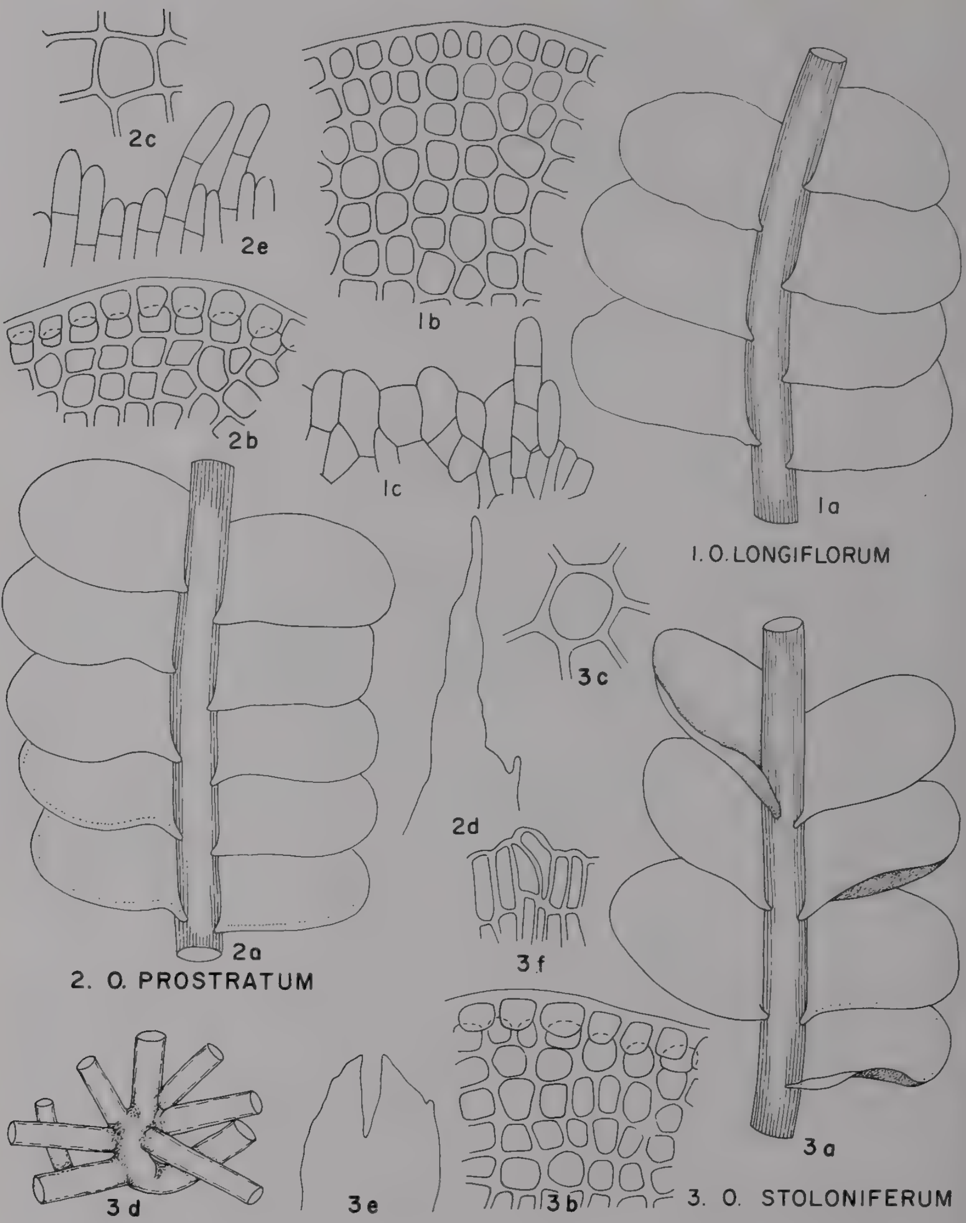

Plate 86

FIG. 1. *Odontoschisma longiflorum.* 1 a. Stem, dorsal view, × 20. 1 b. Cells of the apical margin of a leaf, × 275. 1 c. Portion of the perianth mouth, × 200. Fig. 1 a, b, drawn from the type of *O. planifolium*; fig. 1c, from plants collected by *Fishlock.*

FIG. 2. *O. prostratum.* 2 a. Stem, dorsal view, × 20. 2 b. Cells from the apical margin of a leaf, × 275. 2 c. Cell from the upper part of a leaf, × 500. 2 d. Segment of a female bract, inner series, × 50. 2 e. Portion of the perianth mouth, × 275. Fig. 2a, from material from Jamaica, IJ-78; fig. 2 b, c, from the type; fig. 2 d, e, from Cuba, coll. *Wright.*

FIG. 3. *O. stoloniferum.* 3 a. Stem, dorsal view, × 20. 3 b. Cells of the apical margin of a leaf, × 275. 3 c. Cell from the upper part of a leaf, × 500. 3 d. Branched rhizome and lower part of leafy branches, × 12. 3 e. Part of a female bract, × 50. 3 f. Portion of the perianth mouth, × 200. Drawn from the type.

branched, the branches ventral, leafy, leafy becoming flagelliform, flagelliform stolon-like, or very short sexual. Rhizoids abundant on the underside of the stem. Line of leaf insertion oblique, nearly longitudinal. Leaves widely spreading, plane throughout, subrectangular, the margin straight, the apex broad truncate, rarely retuse; cells of the upper part of the leaf subquadrate in outline, mostly 20 × 20 μ, the walls uniformly thickened, the trigones very small to conspicuous, the cuticle verruculose; marginal cells smaller, 15 × 15 μ, with thicker walls. Underleaves rudimentary, of only a few cells. Plants dioicous. Male inflorescence short ventral, whitish, catkin-like, the bracts in 5–10 series, small, bifid, concave. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, bifid, the segments short-triangular, the margins with short projecting cells. Perianth long, cylindrical below, 3-keeled above, the mouth contracted, crenulate with a few short cilia. Gemmae 2-celled, green, at the tips of erect small-leaved stems.

Pl. 86. Fig. 1, a–c.

Habitat: On decaying logs.

CUBA: Oriente: Sierra Maestra, 1000+ m, *Yuncker 12598* p.p. (DPU); Isle of Pines: s.l., *L. N. & E. G. Britton & Wilson 14779* (NY).

JAMAICA: s.l. or without coll., Hb Lehmann *misit* Taylor (♀) (type S-PA).

PUERTO RICO: s.l., *Heller 1148* (NY), *4749* (MO); Maricos, *Steere 5817* (Hb Fulford); Mt. Britton, *Fulford, Crandall & Stotler 651, 653* p.p. (Hb Fulford); Pico del Oesta 1020 m, *Fulford, Crandall & Stotler 409* p.p. (Hb Fulford).

GUADELOUPE: bois de Baines Jaunes, *Le Gallo 285, 289* (Hb Le Gallo).

DOMINICA: s.l., *Elliott, Hep. Dom. Elliot.* type of *O. planifolium* (BM, G-13235); s.l., *Elliott 1146* (G-13236), *2136* (G-13237); Morne Diablotin, *Elliott 2120* p.p. (BM); Lagona Flats, *Elliott 2136* (BM); Four Hunt, *Fishlock 12, 16b* (NY); Picard Valley, *Elliott 940, 961* (BM); s.l. or without coll. (STR).

COLOMBIA: Intendencia del Meta: Cordillera La Macarena, quebrada Tiranas, 1700 m, *Schultes & Bell 11672* (FH).

VENEZUELA: Choroní Pass, 1595 m, *Fulford & Steyermark 1126* p.p. (Hb Fulford); Bolívar: Cerro Venamo, Sur Oeste, 1400–1575 m, *Steyermark & Dunsterville 92555* p.p. (VEN); Valencia, *Fendler* (G-13250).

BRAZIL: Central Goiás, *Dawson 14315* p.p. (Hb Fulford); Rio de Janeiro, *Glaziou 7231*, type of *O. glaziovii* (G-13232, isotypes C, NY, S-PA); Itatiaia, Maromba River, 1100+ m, *Fulford, Hatcher, Hell & Vital, 766* p.p. (Hb Fulford); Caraça, *Wainio* (BM); S. Paulo: "Brasso Grande," *Schiffner 1288* (S-PA, UPS).

ECUADOR: Azuay: Río Collay, s of El Pan, 2650–3290 m, *Steyermark 53364* p.p. (F).

2. **Odontoschisma prostratum** (Swartz) Trevisan, Mem. Ist. Lomb. III. **4**: 419. 1877.[6]

Jungermannia prostrata Swartz, Prodr. Fl. Ind. Occid. 142. 1788.
Sphagnoecetis prostrata α Nees in G. L. & N. Syn. Hep. 149. 1845.
Pleuroschisma prostratum Mitten, Jour. Linn. Soc. Bot. **15**: 61. 1877.

Plants of small to medium size, pale green becoming brownish, rarely reddish, prostrate with some ascending tips, in mats or creeping among other bryophytes; stems to 3 cm or more long, with leaves to 1.5 mm wide, sparingly branched; branches ventral-intercalary, leafy or flagelliform (stolon-like) or short sexual. Rhizoids abundant over the ventral side of the stem. Leaf insertion oblique. Leaves widely spreading or the rows often folded against one another, distant to imbricate, orbicular to oblong, 0.7–1.0 mm long, 0.3–0.5 mm wide, somewhat concave, with a conspicuous border of elongate cells forming an upturned edge, the apex rounded, or rarely emarginate, the margin entire; cells of the marginal 1–4 rows small, 13–20 × 13 μ, with uniformly thickened walls, cells of the upper part of the leaf 13–18 × 13 μ,

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[6] See a manual of the North American species for a more complete synonymy.

the walls thin, the trigones small, with concave sides, the cuticle verruculose. Underleaves very small, of only a few cells. Plants dioicous. Male inflorescence a short catkin-like ventral branch, the bracts and bracteoles in 6 or more series, the bracts small, shortly bifid, concave, monandrous, the bracteoles small, ovate, bifid. Female inflorescence a very short ventral branch, the bracts and bracteoles in 3 series, ovate, the inner series largest, bifid to one-half, the segments slender, acuminate, spreading. Perianth long-ovoid, to 3 mm long, cylindrical below, with 3 broad, rounded keels above becoming plicate, the mouth irregularly lobed or cleft, short setulose.

Pl. 85. Fig. 2, a–e.

Habitat: On logs in woods.

CUBA: s.l., *Wright, Hep. Cub. Wright.* (MANCH, BM, G-13249, S-PA).

JAMAICA: gap to Caledonia Peak, *M. Farr 682* (IJ); Corn Puss Gap, *M. Farr 623* (IJ); Cuna Cuna Mountain, *M. Farr 1335* p.p., *1383* (IJ); near Ecclesdown, *M. Farr 1150* (IJ), *Proctor 713* (IJ); Fairy Glade, *M. Farr 542* p.p., *780*, *791* p.p. (IJ); *W. Welch 17816* p.p., *17819* p.p. (DPU); Hardwar Gap, *Baxter 9* p.p., *27* (KANU), *M. Farr 565* (IJ), 4000 ft, *Underwood 2241* (NY); Morce's Gap, *Philipson 1222* p.p. (BM), 5000 ft, *Underwood 636*, *637* (NY); Newhaven Gap, *Underwood 1048* (NY); Portland Gap, *Baxter 45* (KANU); St. Catherine's Peak, *Evans 428* (NY); St. Thomas: crest of Gossamer Peak, 8–900 m, *Maxon 9258* (US); s e Stone Hole Bump, 6–800 m, *Maxon 8997* (US); s.l., Andus 2 (BM), *Börgensen* (C), *Eggers 88* (F), *Krebs* (C), *Swartz* (type S-PA, C), *Wikstrom,* Hb Vahl (C), *Wilds* (NY), s.l., Hb Lehmann (S-PA).

PUERTO RICO: Luquillo Mountains, *Heller 1140* (Y); Mt. Britton, *Fulford, Crandall & Stotler 626* p.p. (Hb Fulford).

GUADELOUPE: Hb Lehmann (S-PA).

MARTINIQUE: Calebasse, Morne Paillasse, *Duss 35-161-230* (NY).

3. **Odontoschisma stoloniferum** (Lindenberg & Gottsche) Stephani, Spec. Hep. **3**: 372. 1908.

Sphagnoecetis stolonifera Lindenberg & Gottsche in G. L. & N. Syn. Hep. 688. 1847.

Plants of medium size, the stems tufted from a rhizomatous base, ascending or creeping, pale green to yellow-brown, caespitose or among other bryophytes; leafy stems numerous from a common stolon "joint," to 2.5 cm long, sometimes becoming stolon-like at the tip, with leaves, to 1.5 mm wide, occasionally branched; branches ventral-intercalary, leafy or long stolon-like, branches of the stolons in 3 rows. Rhizoids few, from the ventral side of the stem. Line of leaf insertion oblique. Leaves spreading, more or less ascendant, imbricate, long-oval, the sides parallel, the apex broad rounded, the margin (1 or 2 rows of cells) tending to curve upward; cells of the margin 20×20 μ, with thickened walls, cells of the apical part of the leaf $15–20 \times 15–20$ μ, with thinner walls and small trigones, the cuticle verruculose. Underleaves very small, inconspicuous. Plants dioicous. Female inflorescence a short branch, the bracts and bracteoles in 3 series, ovate, the innermost series largest, bifid to one-third the length, the segments broadly triangular. Perianth 3.5–4 mm long, cylindrical below, 3-keeled and plicate above, the mouth weakly crenulate. Male inflorescence not seen.

Pl. 86. Fig. 3, a–f.

Habitat: Over logs.

MEXICO: Oaxaca: Teotalcingo, 5000 ft, *Liebmann 266b* (type BM, C, G-13254); s.l., *K. Müller* (G-13254); Chiapas: Sierra n of Mapastipec, 6000+ ft, *Sharp 4582* (TENN).

4. **Odontoschisma soratamum** Fulford, sp. nov.

Plantae parvae, fragiles, albo-virides, 1–2.5 cm longae; folia effusa, rectangularia; cellulae $20–26 \times 20–24$ μ, parietibus incrassatis, trigonis parvis, cuticula verrucosa. Amphigastria squamata. Bracteae bracteolaeque feminae patentes, seriebus intimis bifidis ad medium, segmentis longis, anguste triangularibus. Perianthii os longe ciliatum, cilia cellularum quadratarum.

Plants slender, fragile, whitish-green, in dense mats on tree trunks; stems 1–2.5 cm long, with leaves 0.8–1.0 mm wide, prostrate; branches occasional, ventral-intercalary, leafy or small-leaved, or short sexual; stem in transverse section 5–8 cells across, the cortical layer of about 12 rows, scarcely smaller than the cells of the medulla, the walls thickened, with pits. Rhizoids hyaline, long, from the ventral side of the stem or from all around the stolons. Line of leaf insertion oblique. Leaves widely spreading, rectangular, 0.4–0.6 mm long, 0.3 mm wide, plane, the margins straight or irregular, the cells quadrate to rectangular in outline, of the apical margin 15–20 μ, of the upper part of the leaf 20–26 × 20–24 μ, the walls uniformly thickened, the small trigones with concave sides, the cuticle rough-warty. Underleaves scale-like, few-celled. Plants dioicous. Female inflorescence on a short ventral sexual branch, the bracts and bracteoles in 3 or 4 series, spreading, narrowly subrectangular, the outer series oblong, slit by a few cells above, the intermediate series bifid to one-third, the segments broad, triangular, the innermost series bifid to more than one-half, the segments long, slender. Perianth mouth [immature] long-ciliate, the cells quadrate in outline. Male inflorescence and perianth not seen.

Pl. 87. Fig. 4, a–i.

Habitat: In dense light green mats on tree trunks.

COLOMBIA: Amazonas-Vaupés: Río Apaporis, Soratama, 250 m, *Schultes & Cabrera 12883* (type FH).

5. Odontoschisma variabile (Lindenberg & Gottsche) Stephani, Spec. Hep. **3**: 372. 1908.

Sphagnoecetis variabilis Lindenberg & Gottsche in G. L. & N. Syn. Hep. 688. 1847.

Plants of small to medium size, yellow-green to yellow-brown, sometimes becoming reddish, in mats or among other bryophytes; stems to 2 cm long, with leaves to 1.5 mm wide, sometimes becoming flagelliform at the tip, or erect, small-leaved and gemmiparous; branches frequent, ventral-intercalary, leafy, flagelliform (stolon-like) or short sexual. Rhizoids colorless, short, on the ventral side of the stem. Line of leaf insertion oblique. Leaves approximate to imbricate, spreading but slightly ascendant, oblong to broadly ovate with a rounded apex, plane to concave, bordered by one to several rows of thicker-walled cells, the margin curved upward; cells of the border at the tip, 20–24 μ, the walls thickened, cells of the upper part of the leaf mostly 24–30 × 24–30 μ, the walls thin, the trigones small with concave sides, or knot-like, the cuticle verruculose. Underleaves small, scale-like, few-celled. Plants dioicous. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, bifid to one-fourth, hyaline, the cells large. Perianth long, cylindrical below, 3-keeled becoming plicate above, the mouth ciliate. Male inflorescence not seen.

Pl. 88. Fig. 5, a–f.

Habitat: On logs.

MEXICO: Chiapas: Montebello, 5500 ft, *Sharp 3589* (TENN); Oaxaca: Distr. Chinantla, S. Pedro Tepinapa, 2000–2300 ft, *Liebmann, Pl. Mex. 315a* (type C); s.l., *Liebmann* (BM).

GUATEMALA: Baja Verapaz: Civijá, 4100 ft, *Sharp 5177, 5184, 5185* p.p. (TENN); Alta Verapaz: Cerro Chinajá, *Steyermark 45634* (F).

HONDURAS: Morazán: Cerro de Uyuca, 1500 m, *Standley 683* p.p., *734* p.p. (F); the same, 1620–1800 m, *Standley, Williams & Molina R 8023* p.p. (F).

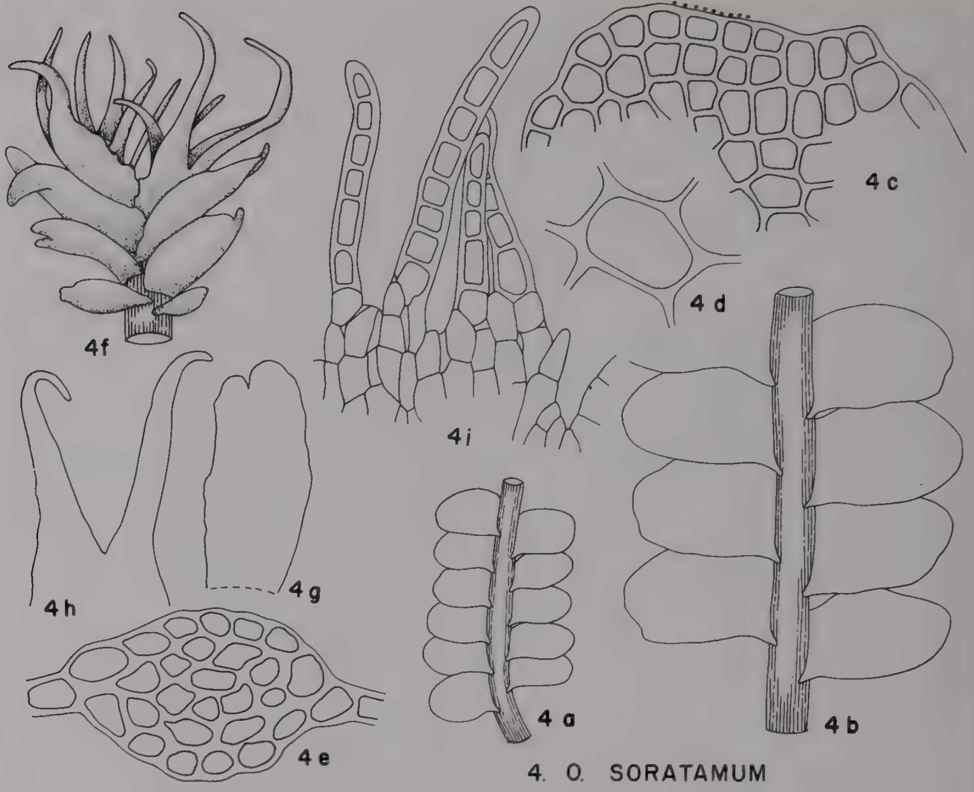

Plate 87

FIG. 4. *Odontoschisma soratamum*. 4 a. Stem, dorsal view, × 20. 4 b. Stem, dorsal view, × 50. 4 c. Cells from the apical margin of a leaf, × 275. 4 d. Cell from the upper part of a leaf, × 500. 4 e. Transverse section of a stem, × 275. 4 f. Female inflorescence, × 50. 4 g. Female bracteole, inner series, × 70. 4 h. Female bract, innermost series, × 70. 4 i. Portion of the perianth mouth, × 200. Drawn from the type.

6. Odontoschisma denudatum (Nees) Dumortier, Recueil Obs. Jungerm. 19. 1835.[7]

Odontoschisma subrotundifolium Stephani, Spec. Hep. **3**: 372. 1908.
Odontoschisma guadeloupense Stephani, Spec. Hep. **3**: 374. 1908.

Plants of medium size, in green, brownish or reddish mats or among other bryophytes; stems to 5 cm long, with leaves, to 2 mm wide, the tips often becoming erect, radial, small-leaved and gemmiparous; branches ventral-intercalary, leafy, flagelliform (stolon-like) or short sexual. Rhizoids long, colorless, from the ventral side of the stem and over the stolons. Line of leaf insertion oblique. Leaves spreading but tending to be ascendant, broadly ovate or rounded-ovate, occasionally retuse, imbricate, usually concave, more or less bordered by thick-walled cells; cells of the border averaging 15 μ, those just below the border larger, 15–24 × 20–24 μ, with thin-walled pits and large knot-like trigones, the cell cavities stellate, the cuticle papillose. Underleaves very small, few-celled. Plants dioicous. Male inflorescence on a short catkin-like ventral branch, the bracts and bracteoles in several series, the bracts whitish, imbricate, shortly bilobed, concave. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, the inner series bilobed to one-third their length, the lobe acute with the margins undulate and dentate. Perianth long, cylindrical below, 3-keeled becoming plicate above, the mouth irregularly crenulate and with a few short cilia. Gemmae green or red, 2-celled, on erect, gemmiparous, radial, small-leaved stems.

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[7] See a manual of North American or European Hepaticae for the long list of synonyms for this widespread predominantly North Temperate species.

Pl. 88. Fig. 6, a–d.

Habitat: On trees, logs, stumps, and cliffs.

CUBA: s.l., *Wright*, as *O. prostratum* (MANCH, NY); Oriente: Sierra Maestra: Pico Truquino, 1600 m, *Ekman 5318* (S-PA, UPS); 2400 m, *Ekman 14517* (S-PA), La Bayamo, *Ekman 7186* (S-PA); Loma Joaquin, 1750 m, *Ekman 14622, 14627* (S-PA); Moa region, *Webster 819* (MICH).

JAMAICA: Newhaven Gap, *Evans 170* (BM, Y, S-PA), *Harris 3, 10099* (NY, S-PA); Portland Gap, *Orcutt 5155 A* (BM); Morce's Gap, 5000 ft, *Underwood 636* p.p. (NY), *Evans 40* (BM); s.l., *Swartz*, as *J. prostrata* (STR).

ST. KITTS: s.l., *Breutel* (S-PA).

GUADELOUPE: Bois des Baines-Jaunes, 600–700 m, *Duss 20-32-91* (♀) (NY); s.l., 680 m, *Duss 32* ex Hb Urban, type of *O. guadeloupense* (G-13233); s.l., *Duss 35*, ex Hb Urban (G-13234); s.l., *l'Herminier* (BM, S-PA, UPS); Soufrière, *Husnot 227* (S-PA), *Husnot, Pl. Antill.* (NY); s.l., 900 m, *Husnot* (G-13256); s.l., *Duss 552*, type of *O. subrotundifolium* (G-13257); Malylis, 1200 m, *Questel 3777* (Hb Questel).

DOMINICA: Morne Micotrin, *Elliott 1147c* (♀) p.p. (BM); Morne Trois Pitons, *Elliott 2280* (G), *2311A* (BM); s.l., *Elliott 665, 680, 934, 1146, 1896, 1902, 1906* (BM).

MEXICO: Chiapas; sierra n of Mapastepec, 6000 ft, *Sharp 4544* (TENN).

GUATEMALA: Izabal: near Lago Izabal, 400–500 m, *Jones & Facey 3306, 3308* p.p. (NY).

BRITISH HONDURAS: Sarawee Pine Ridge, *P. Gentle 2697* (MICH).

BRAZIL: S. Paulo: Estacao Biologica, "Alto de Serra," 800 m, *Hell 160, 776, 778* (Hb Grolle).

7. **Odontoschisma cordifolium** Stephani, Spec. Hep. **6**: 445. 1924.

Plants of medium size, green to yellow-green, in mats or among other bryophytes; stems to 2 cm long, with leaves, 1.5–2.5 mm wide, often becoming small-leaved, gemmiparous at the tips; branches scarce, ventral-intercalary, leafy, stolon-like or short sexual. Rhizoids frequent, on the ventral side of the stem. Line of leaf insertion oblique. Leaves patent, imbricate, broadly ovate, tending to be canaliculate with the dorsal side folded upward, concave, the margins curved upward; cells of the apical margin 15–20 μ, the outer wall thick, cells below the margin 20–24 μ, the walls as thin pits between large, rounded or knot-like, often coalesced trigones, the cuticle verruculose. Underleaves scale-like, of few cells. Gemma hyaline to light-green, 2-celled, on small-leaved gemmiparous stems. Male and female inflorescences and perianth not seen.

Pl. 88. Fig. 7, a–d.

Habitat: On bark.

MEXICO: Chiapas: S. Cristobal, Llanos de Huestan, 2500 m, *Münch*, *Bryol. E. Levier 5632* (isotype NY); e of Las Casas, 7500 ft, *Sharp 4702A* (TENN).

8. **Odontoschisma brasiliense** Stephani, Spec. Hep. **3**: 369. 1908.

Odontoschisma sphagni var. Spruce, Rev. Bryol. **15**: 33. 1888. [*Glaziou no. 11760.*]
Odontoschisma splendens Stephani, Spec. Hep. **3**: 373. 1908. [*Glaziou no. 7227.*]

Plants large, coarse, green, often in part becoming reddish, prostrate, in mats or among other bryophytes; stems to 4–6 cm long, with leaves to 3 mm wide, sometimes

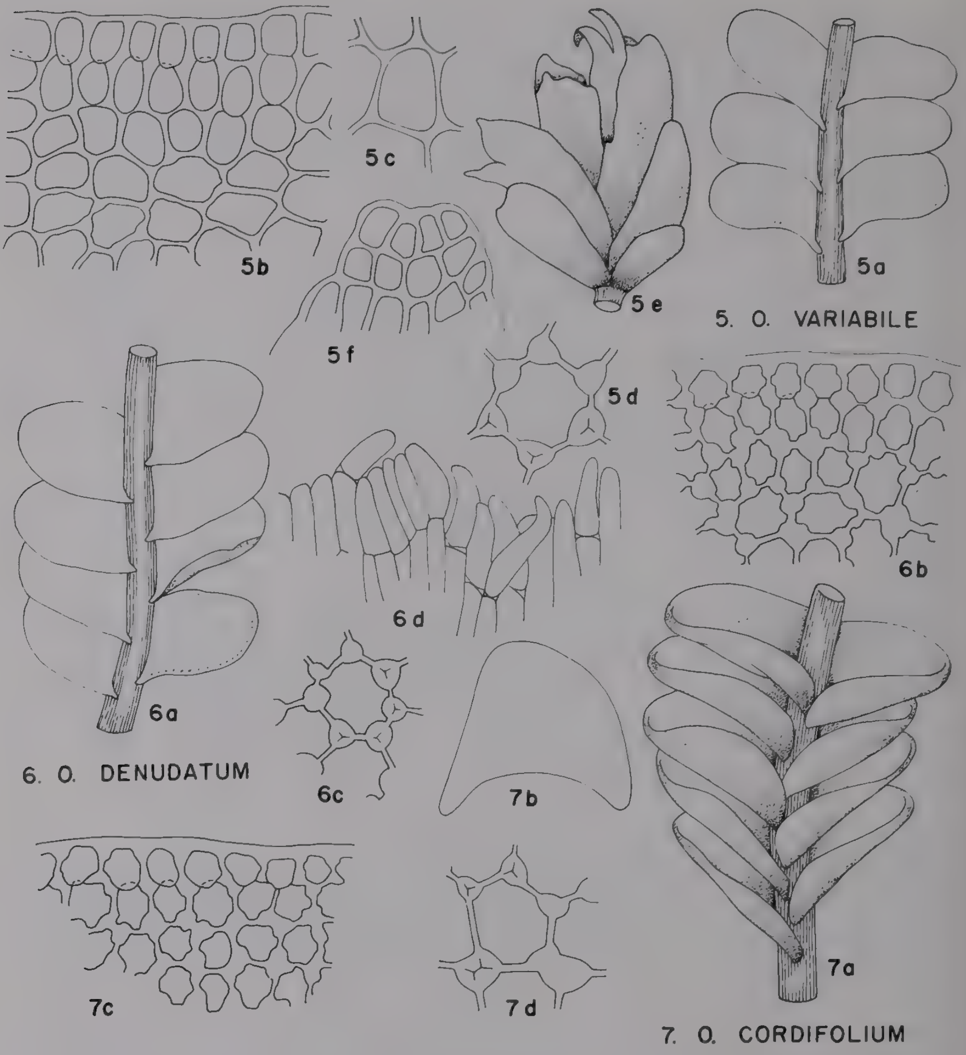


Plate 88

FIG. 5. *Odontoschisma variable.* 5 a. Stem, dorsal view, × 20. 5 b. Cells of the apical margin of the leaf, × 275. 5 c. Cell from the upper part of the leaf, × 500. 5 d. Cell from another leaf of this same stem, × 500. 5 e. Female inflorescence, × 50. 5 f. Tip of a female bracteole, × 200. Drawn from the type.

FIG. 6. *O. denudatum.* 6 a. Stem, dorsal view, × 20. 6 b. Cells from the apical leaf margin, × 275. 6 c. Cell from the upper part of the leaf, × 500. 6 d. Portion of the perianth mouth, × 275. Fig. 6 a–c, from Jamaica, *Evans 170*; 6 d, from Dominica, *Elliott 1147 e.*

FIG. 7. *O. cordifolium.* 7 a. Stem, dorsal view, × 20. 7 b. Leaf, × 20. 7 c. Cells from the apical margin of a leaf, × 275. 7 d. Cell of the upper part of a leaf, × 500. Drawn from the type.

becoming erect, radial, with 3 rows of small leaves, and gemmiparous, the occasional branches ventral-intercalary, leafy, or flagelliform (stolon-like) or very short, sexual. Rhizoids long, from the under side of the stem. Line of leaf insertion oblique. Leaves widely spreading, sometimes the 2 rows folded-appressed, imbricate, plane, orbicular, to 1.3 mm long, 1.0–1.2 mm broad, the apex broad rounded, bordered, the margin often slightly up-curved; cells of the border large, with very thick walls, those of the upper part of the leaf 26 × 26 μ, with thin walls often as narrow pits between the large, rounded trigones, the cell lumina angular to stellate, the cuticle verruculose. Underleaves very small, scale-like, obscure. Plants dioicous. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, the innermost series largest, the bracts divergent above, ovate, bifid to one-third, the segments triangular, the margins irregular. Perianth long, cylindrical below, 3-keeled above, the mouth contracted, crenulate and with a few short cilia. Gemmae two-celled. Male inflorescence not seen.

Pl. 89. Fig. 8, a–f.

Habitat: In forests, in mats on logs, tree bark, more rarely on rocks and stream banks.

TRINIDAD: s.l., *Fendler* (BM, NY).

VENEZUELA: Bolívar: Auyan-tepuí, "Drizzly Camp," 1760 m, *Steyermark 93344*, *93349* (VEN); s.l., *Fendler* (BM).

SURINAM: s.l., Wullschlägel (BM).

BRAZIL: near Rio de Janeiro, *Glaziou 11760*, type of *O. sphagni* var. (G-13228), isotypes as *Sphagnoecetis prostrata* (C, G-13247, NY), isotype as *Pleuroschisma sphagni* (NY); Rio de Janeiro, *Glaziou 7227*, type of *O. splendens* (type G-13253), isotype as *S. prostrata*, (C), isotype as *O. denudata* (S-PA); Merida, *Goebel* (BM); s.l., *Sellow* (BM); s.l., *Ule* (BM); *Minas Gerais*, *Wainio* (BM).

9. **Odontoschisma falcifolium** Stephani, Spec. Hep. **3**: 369. 1908. [*Ule no. 573.*]

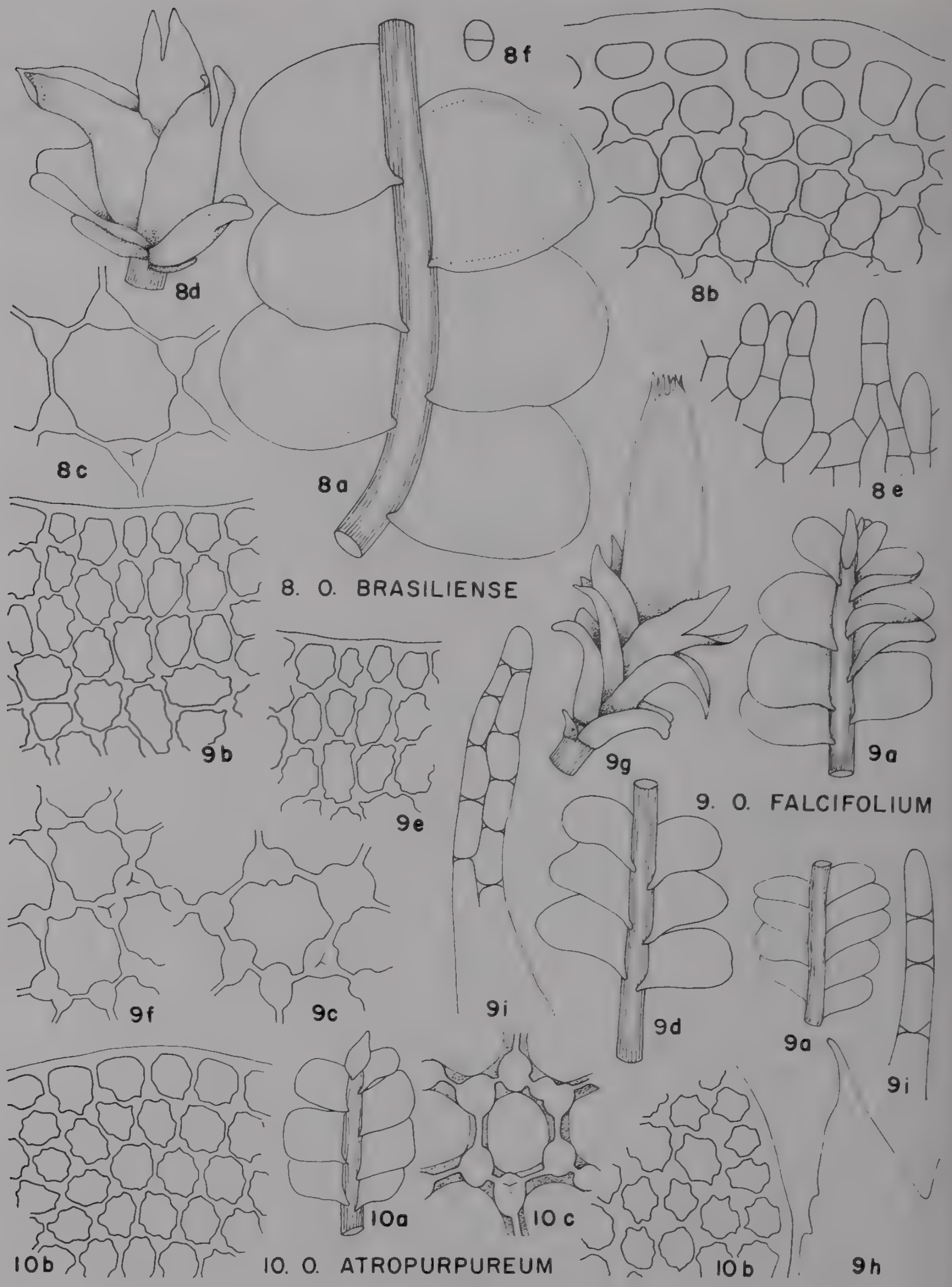
Jungermannia prostrata β brasiliensis Nees in G. L. & N. Syn. Hep. 149. 1845.
Odontoschisma sphagni var. *amazonica* Spruce, Jour. Bot. London **14**: 166. 1879.
Cephalozia subg. *Odontoschisma*, *sphagni* var. *amazonica* Spruce, Trans. Proc. Bot. Soc. Edinb. **15**: 401. 1885.
Odontoschisma sphagni Stephani, Hedwigia **44**: 225. 1905. Non Dumortier. [*Ule no. 573.*]
Odontoschisma caraçanum Stephani, Spec. Hep. **3**: 374. 1908.
Odontoschisma obcordatum var. *falcifolium* (Stephani) Herzog, Hedwigia **71**: 335. 1931.
Odontoschisma cubana var. *minor* Stephani, in Hb.

Plants of medium size, green or tinged with brown, occasionally becoming reddish, in mats or among other bryophytes; stems to 3 cm long, with leaves 1.5–2 mm wide, occasionally becoming flagelliform at the tips; branches ventral-intercalary, leafy or more commonly long-flagelliform stolon-like or very short, sexual, occasionally gemmiparous. Rhizoids abundant, long, from the underside of the stem. Line of leaf insertion oblique. Leaves spreading or the 2 rows folded together, often slightly ascendant, ovate-truncate, to 0.9 mm long, to 0.8 mm broad at the base, narrowed to the broad-rounded apex, the margin straight, usually plane; cells of the apical margin 20–22 μ, the outer wall very thick, cells of the upper part of the leaf mostly 26 × 26 μ, the walls with thin pits and large, knot-like trigones, the cell lumina stellate, the cuticle rough. Underleaves very small, scale-like. Plants dioicous. Female inflorescence on a very short ventral branch, the bracts and bracteoles widely spreading to falcate, in 3 series, the innermost series the largest, bifid to one-half or less, the segments triangular, the margins irregular. Perianth long, 3-keeled from a cylindrical base, the mouth contracted, fringed with cilia and long slender filaments. Gemmae whitish green, 2-celled. Male inflorescence not seen.

Pl. 89. Fig. 9, a–i.

Habitat: Over logs, tree trunks, rocks and soil in forests and savannas.

COLOMBIA: Amazonas-Vaupés: Río Apaporis, Cachivera Jiryirimo, 250 m, *Schultes & Cabrera 11987*, *11996*, *12394*, *12403* (FH); Río Kuduyarí, Yapabodá, *Schultes & Cabrera 14268*, *14302* p.p. (FH); Río Papuré, Teresita, *Schultes & Cabrera 19457* p.p. (FH).


8d
8f
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8. O. BRASILIENSE
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9. O. FALCIFOLIUM
9f
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9d
9a
9i
10b
10a
10 c
10b
10. O. ATROPURPUREUM
9h

Plate 89

FIG. 8. *Odontoschisma brasiliense.* 8 a. Stem, dorsal view, × 20. 8 b. Cells of the upper margin of a leaf, × 275. 8 c. Cell of the upper part of a leaf, × 500. 8 d. Female inflorescence, × 50. 8 e. Portion of the perianth mouth, × 200. 8 f. Gemma. Drawn from the type.

FIG. 9. *O. falcifolium.* 9 a. Stem, dorsal view, × 20. 9 b. Cells of the upper margin of a leaf, × 275. 9 c. Cell from the upper part of a leaf, × 500. 9 d. Stem, dorsal view, × 20. 9 e. Cells of the upper margin of a leaf, × 275. 9 f. Cells of the upper part of a leaf, × 500. 9 g. Fe-

VENEZUELA: Amazonas: between Esmerelda savanna and Cerro Duida, *Steyermark 57825* p.p. (F); Bolívar: Chimantá Massif, Río Tirica, 1940 m, *Steyermark & Wurdack 428* p.p. (NY); Pico de El Avila, 2000 m, *Alston 5575* p.p. (BM).

SURINAM: s.l., *Wullschlägel* (BM).

FRENCH GUIANA: Cayenne, without coll. (STR).

BRAZIL: Itatiaia Park, Rio Maromba, 1100+ m, *Fulford, Hatcher, Hell & Vital 756* p.p., *768*, *770* (Hb Fulford); Agueas Negras, Research Station, 2250 m, *Fulford, Hatcher, Hell & Vital 947* p.p. (Hb Fulford); s.l., *Burchell 226A* (NY); Amazon, *Spruce* (NY); Silva Amazonica: Fl. Negro et Uaupés, *Spruce, Hep. Spruc.*, isotypes of *O. sphagni* var. *amazonica* (♀) (BM, G-13230, NY); Manaos, Rio Negro, *Ule 373* (type G-13231); S. Paulo: s.l., *Schiffner 4282* p.p. (W); Mte Jaragua, 800–1050 m, *Schiffner 1020* (S-PA, UPS, W); "Brasso Grande," 1000 m, *Schiffner 1288* (UPS, W); Alto da Serra, 900 m, *Schiffner 1613* (S-PA, UPS); Caraça, *Wainio 27*, type of *O. caraçanum* (G-13227), same locality, *Wainio*, as *O. cubana* var. *minor* Stephani Hb (BM); Villa Rica, *Martius* and Amer. trop., *Martius*, as *J. prostrata* [= original material of *β brasiliensis* Nees] (STR), the same, Hb Lehmann (S-PA); s.l., *Pater Botmer* (S-PA); Uaupés, Jutica, *Lützelburg 20908* (S-PA).

PERU: s.l., *Montagne* (STR).

10. Odontoschisma atropurpureum Stephani, Spec. Hep. **3**: 369. 1908.[8]

Plants small to tiny, deep red to purple, in mats or more frequently scattered among other bryophytes; stems 1 cm or less long, with leaves 0.5–1.0 mm wide, recurved, the rows of leaves usually folded together; branches ventral-intercalary, rare, leafy or stolon-like, short, whitish or pigmented. Rhizoids few, along the ventral side of the stem. Line of leaf insertion oblique. Leaves tending to be ascendant, orbicular to subrectangular, slightly concave, the margin curved upward; cells of the apical margin mostly 20 μ, the outer wall thickened; cells below the margin 20–25 × 20–15 μ, with thin pits separating the large knot-like trigones, the pits tending to be filled with secondary thickening, with the cell lumen rounded, the cuticle verruculose. Underleaves very small, of a few cells, erect-spreading. Sexual branches not seen.

Pl. 89. Fig. 10, a–c.

Habitat: Over exposed soil, rocks, cliffs and tree trunks, especially at high elevations.

COLOMBIA: Dept. del Valle: Cordillera occid., *Cuatrecasas "A"* (US). Cauca: Páramo de Las Papas, 3530 m, *H. Barclay & Juajibioy 6011* (Hb Barclay). Huila-Cauca: Páramo de Las Papas, 3530–3620 m, *Bischler 672* p.p., *705*, *780* (COL). Vaupés: Río Apaporis, 250 m, *Schultes & Cabrera 12355* (FH); Río Kuduyarí, Yapobodá, *Schultes & Cabrera 14292* (FH); Río Paca, Wacaricuara, 650 ft, *Schultes & Cabrera 19503* (FH).

VENEZUELA: Amazonas: Cerro Yapacana, 100 m, *Maguire, Cowan & Wurdack 30608* p.p. (NY). Bolívar: Chimantá Massif, Río Tirica, *Steyermark & Wurdack*, at 1925 m, *314*, *371* p.p., *380*, *383*, *466*, *469* p.p., at 1940 m, *430*, *431*, at 2165–2180 m, *695* (VEN); Río Ichún, 500 m, *Steyermark 90451* (VEN); Auyan-tepuí, "Drizzly Camp," 1760 m, *Steyermark 93347*, *93351* (VEN); Auyan-tepuí, Río Churun, *Steyermark*, at 1690 m, *93325* p.p., at 2050–3000 m, *93955*, "El Peñon," 2200 m, *Steyermark 94035* p.p. (VEN); Ptari-tepuí, 2410 m, *Steyermark 59837* p.p.,

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[8] Under rigorous conditions of growth *O. denudatum*, *O. falcifolium* and *O. brasiliense* often tend to be very small and red. Without further field study it is not certain what the range of forms of each of these species might be under such conditions.

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male inflorescence with perianth, × 20. 9 h. Outline of a segment of a female bract, inner series, × 70. 9 i. Cilia of the perianth mouth, × 275. Figs. 9 a–c, g–i, from the type; d, e, from *O. sphagni* var. *amazonica Spruce, Hep. Spruc.*; f, from the type of *O. caraçanum*.

FIG. 10. *O. atropurpureum*. 10 a. Stem, dorsal view, × 20. 10 b. Cells of the upper margin of two leaves of the same stem, × 275. 10 c. Cell of the upper part of the leaf, × 500. Drawn from the type.

59872 p.p. (**F**). Miranda: Pico de Naiguatá, 2200–2765 m, *Steyermark 62955* (**F**). Táchira: Páramo de Tamá, 3045–3475 m, *Steyermark 57373* (**F**).

BRAZIL: s.l., *Ule 387* (type G-13226); São Francisco, *Ule* (BM).

ECUADOR: Azuay: Río Collay, s of El Pan, 2650–3290 m, *Steyermark 53375, 53376* (**F**).

The following taxa of *Odontoschisma* have not been studied:

Odontoschisma denudatum var. *andinum* (Spruce) Herzog. 1934.
Cephalozia denudata var. *andina* Spruce. 1885. Peru.
Odontoschisma obcordatum (Spruce) Stephani.
Cephalozia obcordata Spruce. 1882. Fl. Casiquiari.

Reference

Spruce, R. 1876. On *Anomoclada*, a new genus of Hepaticae, and on its allied genera, *Odontoschisma* and *Adelanthus*. Jour. Bot. London **14**: 129–136, 161–170, 193–203, 230–235. *pl. 178, 179.*

Anomoclada Spruce, Jour. Bot. London **14**: 133. 1876.

Odontoschisma auct. p.p.
Sphagnoecetis auct. p.p.

Plants coarse, light yellow-green to brownish, rarely tinged with red. Stems irregularly branched, the branches dorsi- or ventral-axillary intercalary, leafy or flagelliform, or small-leaved gemmiparous, or short sexual; stem in transverse section with a cortical layer of 1 or 2 rows of smaller thick-walled cells surrounding a medulla of larger cells with thinner walls and trigones. Rhizoids abundant along the ventral side of the stem. Line of leaf insertion oblique, the leaves succubous. Leaves subrectangular to long ovate-truncate, the cells thin-walled and with very large rounded trigones, the cell cavity stellate. Underleaves small, broadly ovate, persistent, with abundant stalked or sessile slime cells over the margin and surface. Plants dioicous. Male inflorescence whitish, catkin-like, from the ventral side of the stem or from a flagelliform branch, or rarely terminal on the stem, bracteoles present. Female inflorescence on a short dorsal or ventral branch, the bracts and bracteoles in 3 or 4 series, bifid. Perianth long, whitish, 3-keeled above, the mouth contracted, the 3 lobes incised, long and short ciliate. Gemmae 2-celled, at the tips of leafy shoots.

Type species: *A. mucosa* Spruce, 1876.

Anomoclada mucosa Spruce, Jour. Bot. London **14**: 134. Tab. 178. 1876.

Sphagnoecetis portoricensis Hampe & Gottsche, Linnaea **25**: 343. 1852.
Odontoschisma portoricensis (Hampe & Gottsche) Stephani, Hedwigia **27**: 296. 1888.
Odontoschisma mucosa (Spruce) Stephani, Spec. Hep. **3**: 374. 1908.
Odontoschisma cubanum Stephani, Spec. Hep. **3**: 374. 1908.

Plants of medium size to robust, coarse, light yellow-green, brown on drying, rarely tinged with red, prostrate in dense mats or among other bryophytes; stems to 3 cm or more long, with leaves 2.5–4 mm wide, irregularly branched, the branches intercalary, dorsi-axillary or ventral-axillary, leafy or flagelliform, or small-leaved and gemmiparous at the tip or sexual; in transverse section the stem 10–14 cells across, the cortical layer of 1 or 2 rows of small cells with thick walls, the medulla of larger cells with thinner walls and large trigones. Rhizoids abundant on the ventral side of the stem. Line of leaf insertion oblique. Leaves large, widely spreading, subrectangular, to 2 mm long, 1 mm wide, tending to be plane, the margins more or less undulate or crisped, here and there recurved; cells of the upper part of the leaf mostly 26 × 26 μ, the walls as thin pits between the large, rounded trigones, the cell cavity stellate, the marginal cells slightly smaller, the outer wall very thick, the cuticle verruculose. Underleaves small, broadly ovate, the margins, marginal projections, and much of the surface, covered with stalked or sessile slime papillae which may secrete quantities of slime. Plants dioicous. Male inflorescences in long or short whitish catkins on the ventral side of the stem, the flagelliform branches (in 1–3 rows) or sometimes terminal; bracts and bracteoles in up to 8 series, the bracts short, bilobed, concave, monandrous, the bracteoles tiny, ovate, bidentate. Female inflorescence on a very short dorsal or ventral branch, the bracts and bracteoles in 3 series, the innermost series largest, bifid to one-third, the segments triangular, the margins irregular. Perianth long, whitish, cylindrical below, 3-keeled above, the mouth contracted, incised, ciliate with long and short cilia. Gemmae light green, 2-celled.

Pl. 90. Fig. 1, a–m.

Habitat: In forests, in mats and among other bryophytes on logs and tree bark.

CUBA: s.l., *Wright, Hep. Cub. Wright.* [several packets], isotypes of *O. cubanum* (BM, MANCH, NY); s.l., *Wright, Hep. Cub. Wright*, as *O. prostratum* and *S. communis* (MANCH). Sierra Maestra: Loma del Gato, *Imshaug 24842* (MSC); Oriente: Moa Region, *Webster 811, 812* p.p. (MICH); Sierra Maestra: Cobre Range, *Fr. León, Clement & Rocca 9903* (NY).

COLOMBIA: Vaupés: Río Paca, Wacaricuare, 650 ft, *Schultes & Cabrera 19499* (FH).

VENEZUELA: Bolívar: Chimantá Massif, Tirepón-tepuí, 1200–1500 m, *Wurdack 34059* (NY); base of Carrao-tepuí, 1460–1650 m, *Steyermark 60848* (F); Cerro Venamo (s e, near Br. Guiana border), 950 m, *Steyermark & Dunsterville 92228, 92235*; at 1000 m, *92259* p.p., *92276* p.p.; at 950–1400 m, *92313* (VEN); Sierra Ichún, *Steyermark 90235, 90236* p.p. (VEN); *Steyermark 94136* (VEN).

BRAZIL: San Carlos & Javita, *Spruce, Hep. Spruc.* (type MANCH, isotype NY); Petropolis, *Ule* (BM).

Reference

Spruce, R. 1876. On *Anomoclada*, a new genus of Hepaticae, and on its allied genera, *Odontoschisma* and *Adelanthus*. Jour. Bot. London **14**: 129–136, 161–170, 193–203, 230–235. *pl. 178, 179.*

Cladopodiella Buch, Mem. Soc. Fauna Fl. Fenn. **1**: 89. 1925 (1927).

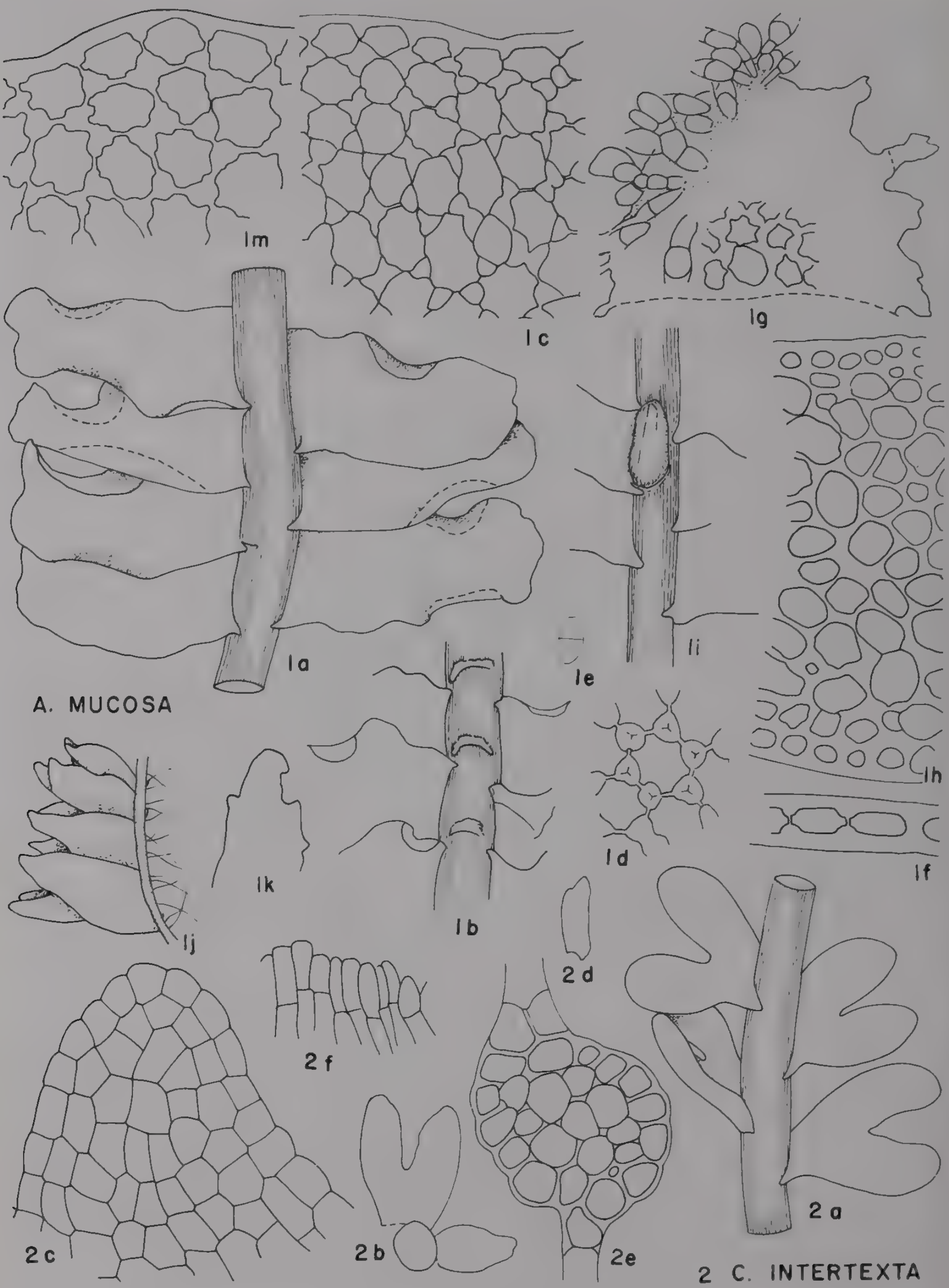
Cephalozia sect. *Cladopus* Spruce, On *Cephalozia* 50. 1882.
Cladopus Meylan, Hep. Suisse 203. 1924. Non Möller, 1899.
Eucephalozia subg. *Cladopus* Schiffner in Engler & Prantl, Nat. Pflanzenf. $\mathbf{1}^3$: 97. 1895.

Plants green, irregularly branched; branches lateral, of the *Frullania* type with the half-leaf dorsal, leafy, or more frequently ventral-intercalary, in the axils of the underleaves, leafy or flagelliform. Stem in transverse section of similar cells. Rhizoids from cells of the ventral side of the stem. Line of leaf insertion oblique, the leaves succubous. Leaves ovate- to obovate-truncate, divided to one-half or less into 2 blunt segments. Underleaves small, ovate to lanceolate. Female inflorescence terminal on the stem or a leafy branch, the several bracts and bracteoles bilobed. Perianth exserted, cylindrical below, 3-keeled above, the mouth undulate, entire or crenulate.

Type species: *Jungermannia francisci* Hooker, 1816.

Cladopodiella intertexta (Gottsche) Fulford, comb. nov.

Jungermannia intertexta Gottsche in G. L. & N. Syn. Hep. 107. 1844.
Cephalozia intertexta (Gottsche) Stephani, Spec. Hep. **3**: 312. 1908.
Cephalozia obtusata Stephani in Duss, Muscineés des Antill. franç. 23. 1903. nomen nudum.
Cephaloziellopsis schistochila var., Schuster in Hb.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2 C. INTERTEXTA

Plate 90

FIG. 1. *Anomoclada mucosa.* 1 a. Stem, dorsal view, × 20. 1 b. Stem, ventral view, × 20. 1 c. Margin of the apical portion of a leaf, × 275. 1 d. Cell from the upper portion of a leaf, × 500. 1 e. A gemma. 1 f. Transverse section of leaf cells, × 200. 1 g. Underleaf wtih slime cells, × 200. 1 h. Transverse section of a portion of a stem, × 200. 1 i. Stem with a dorso-axillary branch, × 20. 1 j. Male inflorescence, × 70. 1 k. Female bract, × 50. 1 m. Margin of

Plants small, delicate, prostrate to ascending, light green, in tufts or among other bryophytes; stems to 1 cm or more long, with leaves mostly 0.5–0.8 mm wide, irregularly branched, the branches lateral, leafy, of the *Frullania* type or ventral-intercalary, axillary and leafy or often flagelliform; stem in transverse section 5–8 cells across, the cells rather large. Rhizoids from cells of the ventral side of the stem. Line of leaf insertion oblique. Leaves distant to approximate, bilobed, cuneate, to 0.65 mm long, to 0.45 mm wide at the middle, divided to one-half their length, the two segments oblong, spreading, rounded at the apex, the margins more or less crenulate; cells of the leaf segment subquadrate to rectangular in outline, 26–30 × 20 μ, the walls thin, without trigones, the cuticle smooth. Underleaves small, linear to ovate. Plant dioicous. Female inflorescence terminal on the stem or branch, the bracts and bracteoles in 2 or 3 series, similar to the leaves, slightly larger. Perianth cylindrical below, 3-keeled above, the mouth slightly contracted, crenulate. Male inflorescence and sporophyte not seen.

Pl. 90. Fig. 2, a–f.

Habitat: On moist soil banks, wet rocks or rarely on trees in forests.

ST. KITTS: Mt. Misery, *Breutel* (type G-13206).

GUADELOUPE: s.l., *Duss 1000* (G-13207).

DOMINICA: s.l., *Elliott 1236* (♀) (G-13210); the same, as *C. obtusata* Steph. = *Cephaloziopsis schistochila* var. Schust. (BM).

MARTINIQUE: s.l., *Duss 1173* (G-13209).

ST. LUCIA: Castries, 300 ft, *Simmonds 202* (MICH).

TRINIDAD: Blue Basin, 250 ft, *Simmonds 312* (MICH).

GUATEMALA: Quezaltenango: Fuentes Georgianas, slopes of Volcán de Zunil, 2300–2500 m, *Standley 86027*, *86052* (F).

BRAZIL: Serra das Orgãos, *Lützelburg 7312* (S-PA).

Alobiellopsis Schuster, Nova Hedwigia **10**: 25. 1965.

Cephalozia subg. IV *Alobiella* Spruce p.p.
Alobiella (Spruce) auct. p.p.

Plants small, flaccid, whitish or becoming tinged with red; stems irregularly branched, the branches ventral-intercalary, leafy or stolon-like flagelliform, becoming leafy in the outer part; in transverse section five or six cells across, the cortical layer of 8–12 rows, the cells of the medulla similar but with thin walls and small trigones. Rhizoids abundant, long, from the ventral side of the stem, colorless or tinged with brown. Leaf insertion oblique, the leaves succubous. Leaves orbicular to ovate with a broad rounded apex or rarely retuse, or truncate or blunt-pointed. Underleaves of 1 or 2 cells, becoming larger just below the female inflorescence. Male inflorescence terminal becoming intercalary on the leafy axis, the bracts more or less leaf-like with the dorsal side folded forming a pouch, monandrous, the bracteoles of only a few cells; antheridia large. Female inflorescence terminal on the stem or a short branch, the bracts and bracteoles in several series, the outer series like the leaves, the inner series larger, bifid. Perianth short, cylindrical below, with 3 broad keels above, lobed and crenulate to spinose. Gemmae at the tips of stems.

Type species: *Cephalozia acroscypha* Spruce, 1885.

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the apical portion of a leaf, × 275. Fig. 1 a–k, from an isotype (NY); 1 m, from the type of *O. cubanum*.

FIG. 2. *Cladopodiella intertexta*. 2 a. Stem, dorsal view, × 40. 2 b. Leaf and underleaf on a tiny stem, × 50. 2 c. Segment of a leaf, × 200. 2 d. Underleaf, × 50. 2 e. Transverse section of a stem, × 200. 2 f. Portion of a perianth mouth, × 200. Fig. 2 a–e, from Guadeloupe, *Duss 1000*; 2 f, from Dominica, *Elliott 1236*.

Key to the Species

Leaf apex broad, rounded, bordered by cells elongate parallel to the margin; the cells to 65 × 20 μ.	1. *A. acroscypha.*
Leaf apex narrow, blunt to subacute, not bordered; marginal cells 26–34 μ long and wide.	2. *A. dominicensis.*

1. **Alobiellopsis acroscypha** (Spruce) Schuster, Nova Hedwigia **10**: 25. 1965.

Cephalozia subg. *Alobiella, acroscypha* Spruce, On *Cephalozia* 30. 1882.
Alobiella acroscypha (Spruce) Stephani, Spec. Hep. **3**: 354. 1908.

Plants small, whitish, flaccid, prostrate, in patches in depressions on clay soil; stems slender, delicate, to 1 cm long, with leaves 0.5–1.0 mm wide, occasionally branched; branches ventral-intercalary, leafy or stoloniferous-flagelliform, often becoming leafy; stem in transverse section 6–8 cells across, the cortical layer of 11–14 rows of cells surrounding a medulla of similar cells. Rhizoids abundant, long, from the ventral side of the stem, sometimes slightly brownish. Line of leaf insertion oblique. Leaves widely spreading to patent, distant to approximate, orbicular, mostly 0.37–0.45 mm long, 0.2–0.25 mm wide, the apex broad-rounded or more rarely truncate or emarginate, the margins entire, bordered by elongate cells parallel to the margin, to 65 × 20 μ; cells of the upper part of the leaf 26–33 × 26–33 μ, those of the lower half elongate, the walls uniformly thickened, the trigones tiny, the cuticle verruculose. Underleaves absent or of 1 or 2 cells on vegetative stems, becoming larger, conspicuous, ovate to bidenticulate toward a female inflorescence. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or long branch, the bracts in 4–10 series, broad-ovate, the dorsal edge folded up to form a pouch, monandrous; antheridia very large, short-stalked. Female inflorescence terminal on the stem or branch, the bracts and bracteoles in 1–3 series, the outer series leaf-like, the inner series larger, the bracts and bracteoles bifid to one-third their length, the segment margins entire. Perianth short, cylindrical below, with 3 broad rounded keels above, the mouth somewhat contracted, lobed and crenulate to spinose. Gemmae 2-celled, in greenish clusters at the tips of stems. Sporophyte not seen.

Pl. 91. Fig. 1, a–e.

Habitat: In depressions on clay soil.

PERU: Monte Guayrapurina, *Spruce, Hep. Spruce.* (type MANCH, isotypes BM, G-1912, NY).

2. **Alobiellopsis dominicensis** (Spruce) Fulford, comb. nov.

Alobiella dominicensis Spruce, Jour. Linn. Soc. Bot. **30**: 355. *tab. 26, figs. 5–9.* 1895.

Plants small, flaccid, prostrate, in whitish or reddish patches in depressions on clay soil; stems short, to 1 cm long, with leaves 0.5–1 mm broad, branches frequent, ventral-intercalary, leafy or flagelliform and becoming leafy in the outer part; stems in transverse section of a cortical layer of 10–12 rows of cells with 2 ventral rows smaller, surrounding the medulla of similar cells. Rhizoids abundant from the underside of the stem, long. Line of leaf insertion oblique. Leaves widely spreading to ascendant, the 2 rows often tending to be folded together, distant to imbricate, ovate, 0.4–0.5 mm long, 0.2–0.25 mm broad at the middle, the apex narrowed, rounded, blunt-pointed or truncate, the margins entire, not bordered; cells of the apical margin mostly 26–34 μ long and broad, of the lateral margins longer, cells of the upper part of the leaf 34–40 μ long and broad, the walls uniformly thin, the trigones

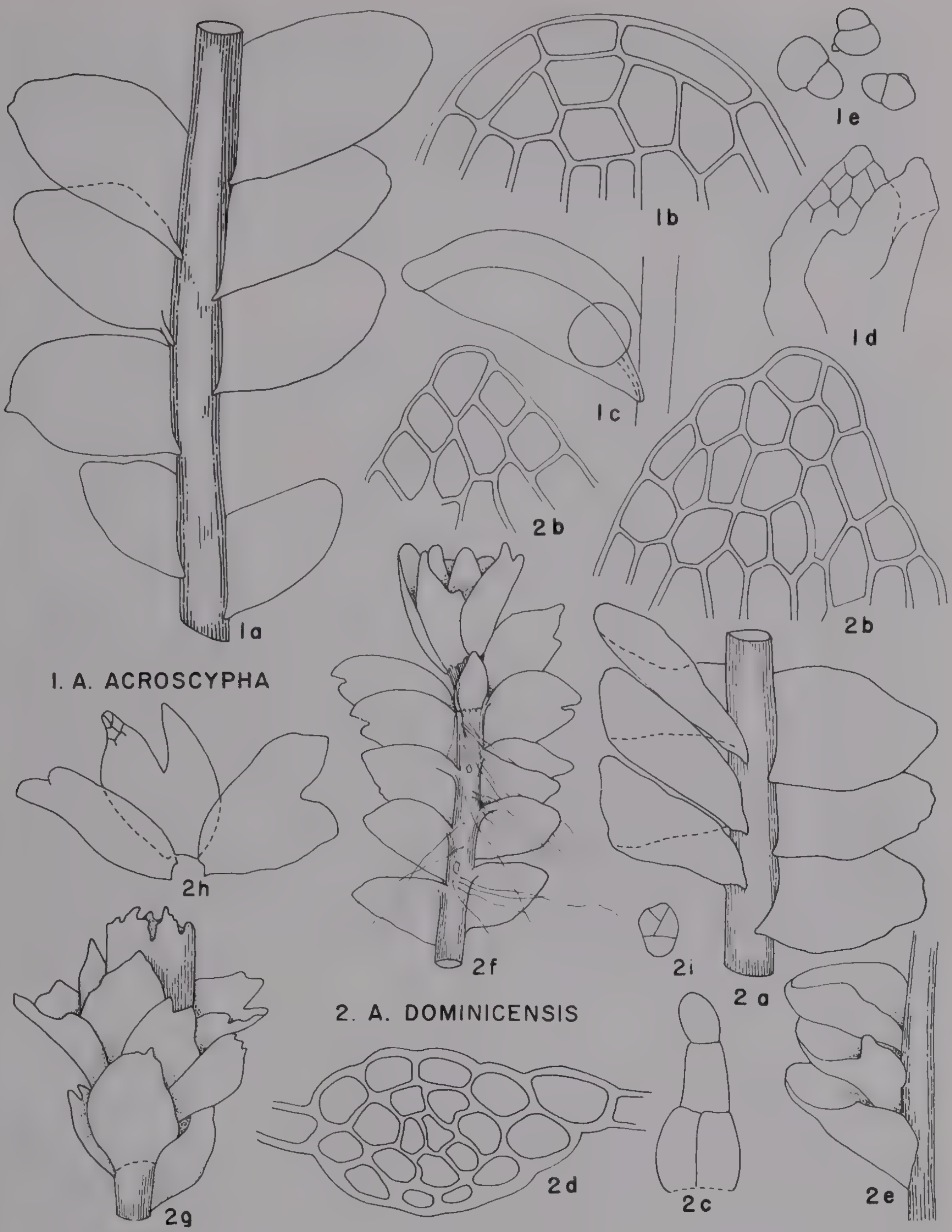

Plate 91

FIG. 1. *Alobiellopsis acroscypha.* 1 a. Stem, dorsal view, × 70. 1 b. Upper part of a leaf, × 200. 1 c. Male bract and antheridium, × 70. 1 d. Upper part of a female bract, × 70. 1 e. Gemmae. Drawn from the type.

FIG. 2. *A. dominicensis.* 2 a. Stem, dorsal view, × 70. 2 b. Upper portion of leaves, × 200. 2 c. Underleaf, × 200. 2 d. Transverse section of a stem, × 200. 2 e. Male bracts, dorsal view, × 50. 2 f. Stem with female inflorescence, ventral view, × 27. 2 g. Female inflorescence and perianth, ventral view, × 27. 2 h. Young female bracts and bracteole, inner series, × 70. 2 i. Germinating gemma. Fig. 2 a–e, h–i, from the type; fig. 2 f, g, after Spruce, 1895.

tiny, the cuticle faintly verruculose. Underleaves of 1 or 2 cells on vegetative stems, becoming larger, ovate to retuse near the tips of female branches. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or leafy branch, the bracts in 4 to 8 series, leaf-like, ovate, folded, monandrous, bracteoles tiny. Female inflorescence terminal on a leafy axis, the bracts and bracteoles in several series, somewhat larger than the leaves, broadly ovate, retuse or bifid, the bracteoles broad-ovate to shortly bifid. Perianth short, cylindrical below, obscurely 3-keeled above, the mouth irregularly torn, lobed, crenulate (?). Gemmae 2-celled, green or reddish, in clusters at the tips of the stems.

Pl. 91. Fig. 2, a–i.

Habitat: In depressions on moist clay soil.

PUERTO RICO: Pico del Oeste, 1020 m, *Fulford, Crandall & Stotler 402, 412* (Hb Fulford); Indiero Baja, n of Yauco, 800–900 m, *Britton & Britton 7240* (NY).

DOMINICA: Laudat, Valley Roseau, *Elliott 68, 81* (type MANCH), *82* (BM); Laudat, *Lloyd 277* p.p. (NY).

MARTINIQUE: Bois de la Medaille, *Duss 1181* (NY).

TRINIDAD: s.l., *Fendler* (NY).

TRABACELLULACEAE Fulford in Steyermark, Acta Bot. Venezuelica **2**: 85. 1967.

Leafy stems flattened, prostrate, pigmented with brown, suggesting a coarse brownish *Cephalozia* or *Odontoschisma*, the branches ventral-intercalary, leafy or occasionally short, male or female; stems with 2–5 rows of large cells on the dorsal side between the rows of leaves; in transverse section the cortical layer a row of 10–12 large cells (those of the ventral side sometimes smaller), surrounding a medulla of many small cells with thickened walls. Rhizoids scattered on the ventral side of the stem. Line of leaf insertion oblique, sublongitudinal. Leaves succubous, subquadrate, retuse to bifid, broadly ovate-truncate, the cells large, with or without conspicuous bands of thickening on the walls. Underleaves none. Male inflorescence terminal becoming intercalary on the stem or occasionally on a short ventral branch, the bracts large, the bracteoles absent. Female inflorescence on a short ventral branch, the bracts and bracteoles in 4–6 series, the outer series bifid, the inner series larger, bi-, tri- or quadrifid. Perianth long, 3-keeled above, the third keel ventral, of 1 or 2 layers of cells below, 1 layer above, the mouth contracted, setulose to short-ciliate. Sporeling or sporophyte not seen.

Type genus: *Trabacellula* Fulford, 1968.

Key to the Genera

Leaves subquadrate to rounded, undivided or scarcely retuse; leaf cells with conspicuous bands of thickening, even in dried material. *Trabacellula.*

Leaves subquadrate, bifid; leaf cells with occasional very weak bands of thickening. *Fuscocephaloziopsis.*

Trabacellula Fulford in Steyermark, Acta Bot. Venezuelica **2**: 86. 1967.

Plants coarse, of the habit of a large *Odontoschisma*, pigmented with brown, irregularly branched; branches ventral-intercalary, leafy or more rarely bearing a male or female inflorescence; stem flattened, with several dorsal rows of cells between the 2 rows of leaves; in transverse section of 10–12 rows of similar, large cortical cells surrounding the medulla of many smaller cells with thickened brown walls. Rhizoids from the ventral side of the stem, short, the tips branched. Line of leaf insertion almost longitudinal. Leaves subquadrate, slightly retuse, the upper (postical) base conspicuously cordate by a few cells, leaf cells as well as those of the rest of the plant, more or less opaque from numerous dense yellow-brown bands over the surface, the cells large, tumid, the walls thin, yellow-brown, the trigones tiny, the cuticle rough. Underleaves absent, occasionally 2 slime papillae present on the stem. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or on a short branch, the bracts large, more or less leaf-like, inrolled-pouched on the dorsal side, bracteoles absent. Female inflorescence on a short ventral branch, the bracts and bracteoles in about 4 series, bifid to quadrifid. Perianth long, cylindrical below, 3-keeled above, the mouth contracted, setulose. Sporophyte not seen.

Type species: *Trabacellula tumidula* Fulford, 1968.

Trabacellula tumidula Fulford in Steyermark, Acta Bot. Venezuelica **2**: 86. 1967.

Plants coarse, yellow-brown when dry, prostrate, in mats or scattered among other bryophytes. Stems to 3 cm long, with leaves 0.8–1.0 mm wide, occasionally branched; branches ventral-intercalary, leafy or short male and female; stems in transverse section of a cortical layer of 10–12 large cells two or more times the diameter of the many small cells of the medulla, the walls brown. Rhizoids scattered on the ventral side of the stem, short brownish. Leaf insertion sublongitudinal. Leaves subquadrate, 0.5–0.7 mm long, to 0.5 mm wide, plane, tending to be retuse, the upper (postical) base cordate by a few cells, sometimes with a suggestion of a tooth above the base, the margins crenulate, the lower base straight; leaf cells large, those of the margin mostly 39–45 μ long, 65 μ wide, those of the upper part of the leaf 45–65 × 45–50 μ, the walls uniformly thickened, yellow-brown, the trigones minute, the cuticle coarsely roughened; all cells more or less opaque from the numerous dense yellow-brown bands closely placed over the surface. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or rarely on a short ventral branch, the bracts in 3–5 series, nearly as large as the leaves, incurved and forming a large pouch on the dorsal side of the stem; bracteoles absent. Female inflorescence on a short ventral branch, the bracts and bracteoles in about 4 series, the bracts of the outer series bifid, of the innermost series tri- or quadrifid to one-half their length, each segment often with 1 lateral tooth, the bracteoles smaller, oblong undivided or bifid. Perianth long, cylindrical below, 3-keeled above, the wall of one, in places of two, layers of cells, the mouth contracted, setulose. Sporophyte not seen.

Pl. 92. Fig. 1, a–j.

Habitat: Moist bases of sandstone cliffs.

VENEZUELA: Bolívar: Sarven-tepuí, between "Camp 5" and base of lower escarpment, 1750–2000 m, *Wurdack 34106* p.p., *34107* (type, NY); Auyan-tepuí, Río Churún, foot of "Second Wall," 1600 m, *Steyermark 93821* p.p. (VEN).

Fuscocephaloziopsis Fulford, gen. nov.

Alobiella auct. p.p.

Plantae grossae, olivaceae; caulium cortex cellulis magnis medulla cellulis parvioribus trigonis magnis. Rhizoidia ventralia. Folia sublongistrorsum inserta. Folia patentia, subquadrata breviter bifida, parietibus cellularum tenuibus. Amphigastria obsoleta. Inflorescentia masculina terminalis vel intercalaris, bracteis magnis foliiformibus, saccatis, bracteolis carentibus. Inflorescentia feminea in ramo brevi ventrali, bracteis bracteolisque in 4–6 seriebus, bifida, trifida, vel quadrifida, segmentis longis triangularibus. Perianthium tubulare, ore setuloso-ciliato.

Plants suggesting a coarse brownish, turgid *Cephalozia*, irregularly branched, the branches ventral-intercalary, leafy, with an occasional short branch bearing a male

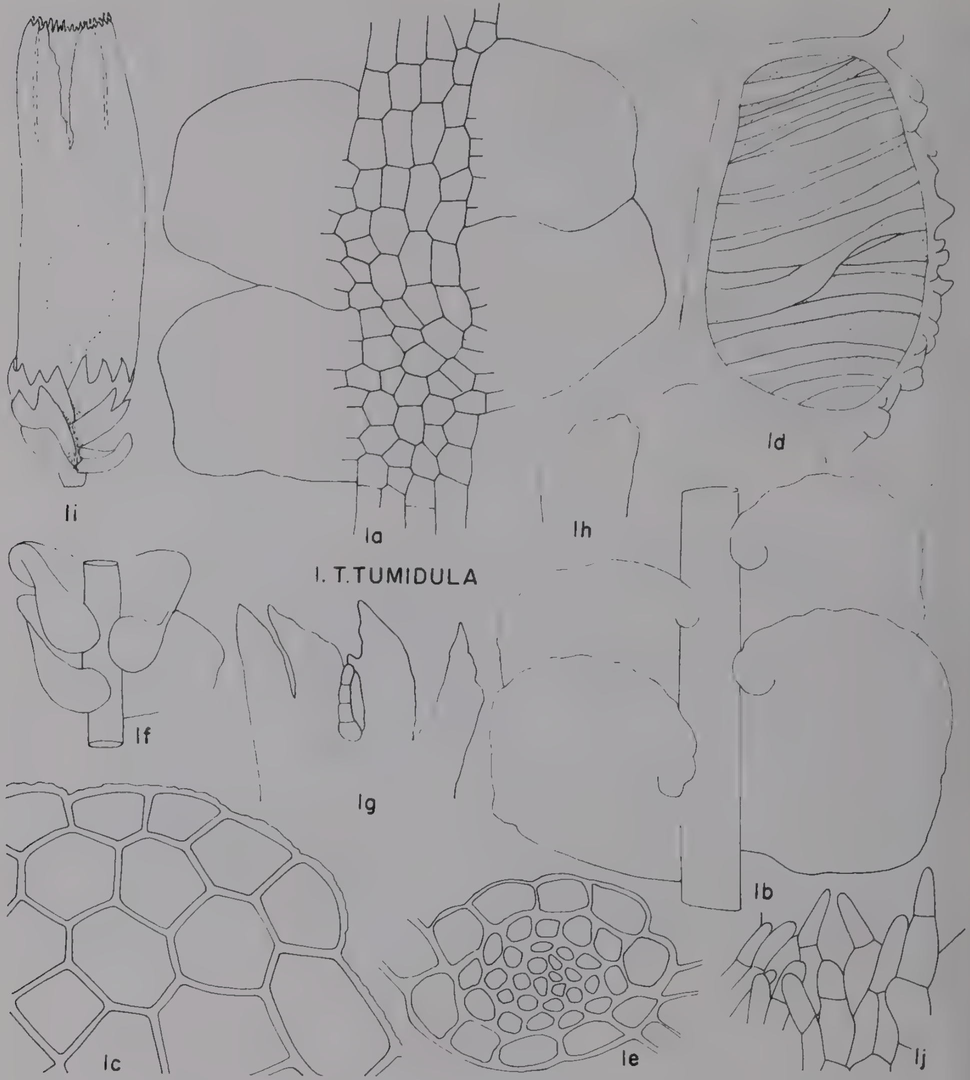

Plate 92

FIG. 1. *Trabacellula tumidula.* 1 a. Stem, dorsal view, × 75. 1 b. Stem, ventral view, × 75. 1 c. Cells of the upper margin of a leaf, × 200. 1 d. Marginal cell of a leaf showing the bands and rough surface, × 700. 1 e. Transverse section of a stem, × 150. 1 f. Three male bracts and a leaf, dorsal view, × 35. 1 g. Female bract, inner series, × 35. 1 h. Female bracteole, × 35. 1 i. Female inflorescence and perianth, × 25. 1 j. Portion of the mouth of a perianth, × 150. After Fulford, 1967.

or female inflorescence. Stems somewhat flattened, with 2 dorsal rows of large cells between opposite rows of leaves; stem in transverse section brownish, with a layer of about 10 rows of large thin-walled cortical cells (the ventral rows a little smaller), surrounding the medulla of smaller cells with thicker walls, conspicuous trigones, and narrow pits. Rhizoids on the ventral side of the stem. Leaf insertion sublongitudinal, the leaves succubous. Leaves subquadrate shortly decurrent, bilobed, the segments short-triangular, the sinus broad, lunulate; cells large, without conspicuous trigones, occasionally showing a suggestion of weak bands of thickening over the surface. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or on a branch, the bracts slightly smaller than the leaves, pouched, the bracteoles absent. Female inflorescence on a short ventral branch, large, "bushy," the bracts and bracteoles in 4–6 series, deeply bi-, tri-, and quadrifid, the segments long, narrow. Perianth brown, long, tubular with 3 weak keels above, the mouth broad, appearing truncate, irregularly setulose and ciliate, the cilia 1–4 cells long.

Type species: *Alobiella pulvinata* Stephani, 1908.

Key to the Species

Margin of the upper half of the leaf strongly crenulate; cells of the margin mostly 39 μ high, 39–52 μ wide; 1. *F. biloba.*

Margin of the upper half of the leaf entire or with weak crenulations; cells of the margin mostly 26 μ high, 52–65 μ wide. 2. *F. pulvinata.*

1. **Fuscocephaloziopsis biloba** (Herzog) Fulford, comb. nov.

Alobiella biloba Herzog, Repert. Sp. Nov. **57**: 166. *f. 5, e-l.* 1955.

Plants of medium size, coarse, yellow-green, prostrate in mats or creeping among other bryophytes; stems 1–2 cm long, with leaves, to 1.5 mm wide, irregularly pinnate, the branches rare or frequent, ventral-intercalary, leafy, occasionally short and bearing a female inflorescence. Stems somewhat flattened, with two or three dorsal rows of large cortical cells between the row of leaves; stem in transverse section brown, the cortical layer of about 10 very large cells surrounding the medulla of numerous smaller, thick-walled cells with trigones and narrow pits. Rhizoids numerous, from cells of the ventral side of the stem. Leaf insertion nearly longitudinal. Leaves widely spreading, slightly decurved, subimbricate, 1.0 mm long, 0.8 mm wide, broadly ovate, bilobed to one-fourth their length, the segments short-triangular, mostly erect, with conspicuously crenulate margins, the ventral base decurrent, the sinus lunulate, the dorsal margin convex above a straight base; cells of the upper part of the leaf 78–100 × 50–65 μ, the walls light brown, uniformly thickened, the trigones tiny, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal on the stem or on a short ventral branch; bracts in to 10 or more pairs, similar to, and nearly as large as the leaves, ascendant, folded, pouched. Female inflorescence on a short branch, the bracts and bracteoles in 4–6 series, the innermost bracts quadrifid to nearly one-half their length. Perianth long, the mouth setulose and ciliate, the cilia to 4 cells long.

Pl. 93. Fig. 1, a–h.

Habitat: In mats on trunks of trees.

TRINIDAD: s.l., *Crüger* (♂) (NY); Mt. Aripo, *Simmonds 173* (♀) (MICH).

COLOMBIA: El Valle: Córdoba, Dagua Valley, 80–100 m, *Killip 5248* (♀, ♂) (type Hb Herzog, US), same locality, *Killip 11784* (♀) (US).

2. **Fuscocephaloziopsis pulvinata** (Stephani) Fulford, comb. nov.

Alobiella pulvinata Stephani, Spec. Hep. **3**: 356. 1908.

Plants of medium size, coarse, yellow-green becoming brown, prostrate, in mats or among other bryophytes. Stems 1–2 cm long, with leaves, 1.0–1.5 cm wide, rarely branched, the branches ventral-intercalary, leafy, occasionally short and bearing a

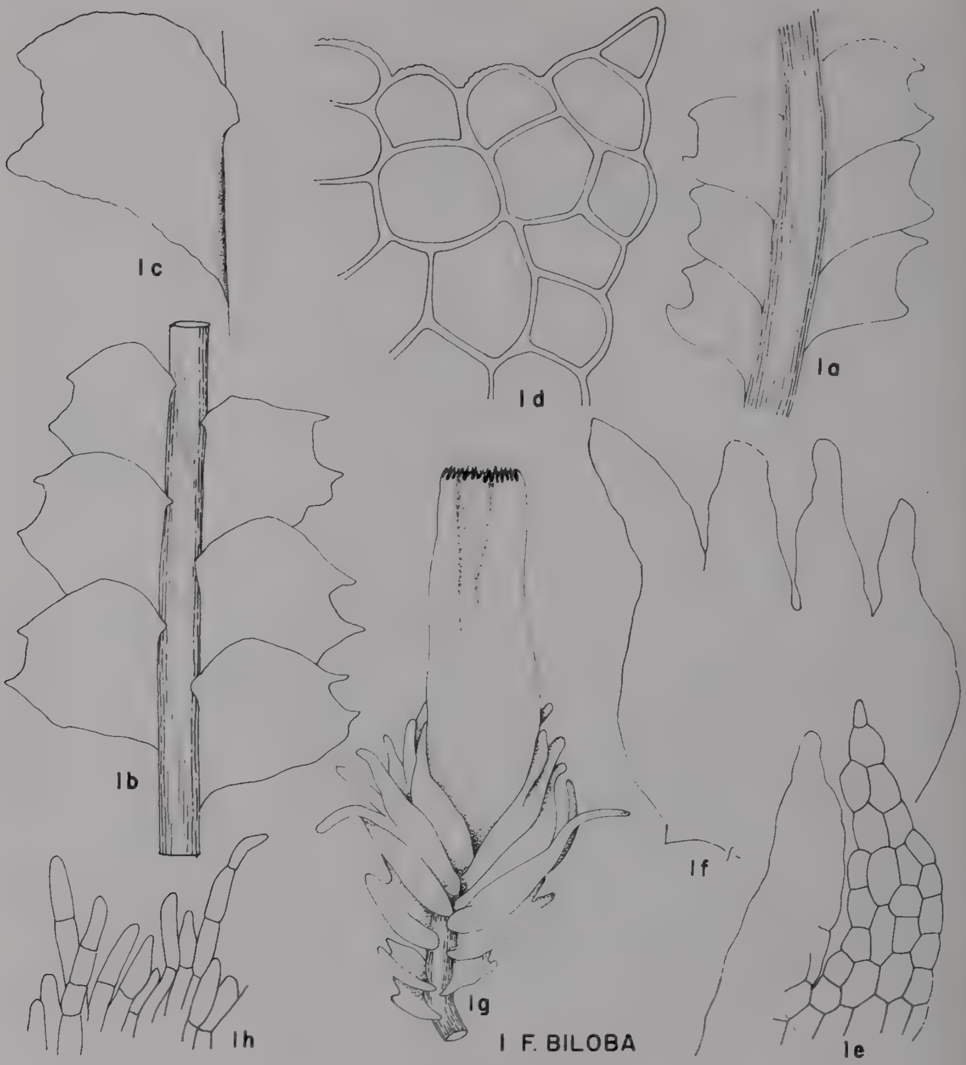

Plate 93

FIG. 1. *Fuscocephaloziopsis biloba*. 1 a. Stem, dorsal view, × 20. 1 b. Stem, ventral view, × 20. 1 c. Leaf showing insertion, ventral view, × 50. 1 d. Portion of a leaf, × 200. 1 e. Female bract, outer series, × 50. 1 f. Female bract, innermost series, × 50. 1 g. Female inflorescence and perianth, × 10. 1 h. Portion of a perianth mouth, × 200. Figs. 1 a–d, from the type; 1 e–h, from Trinidad, *Simmonds 173*.

female inflorescence; stems tending to be flattened, in transverse section of about 10 rows of large, thin-walled cortical cells (the ventral rows smaller), surrounding the medulla of numerous smaller, thick-walled cells with trigones and pits. Rhizoids numerous from the ventral side of the stem. Leaf insertion nearly longitudinal. Leaves widely spreading, subimbricate, subquadrate, the lateral margins curved, bilobed to about one-sixth the length, the segments triangular, of only a few cells, the sinus broad, lunulate, the margin at most weakly crenulate; cells of the upper part of the leaf 52–78 × 52–65 μ, the marginal cells smaller, 26 μ high × 52–65 μ wide,

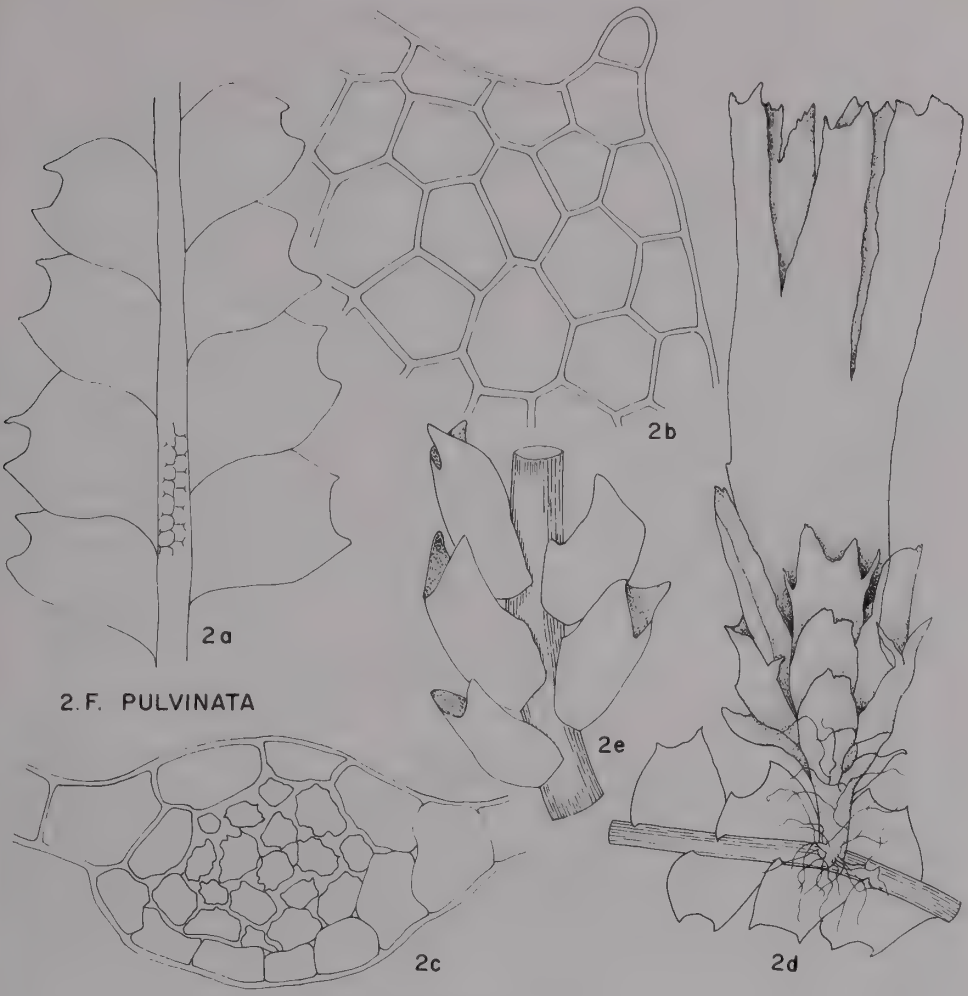

Plate 94

FIG. 2. *Fuscocephaloziopsis pulvinata.* 2 a. Stem, dorsal view, × 20. 2 b. Cells from the upper portion of a leaf, × 200. 2 c. Transverse section of a stem, × 200. 2 d. Female inflorescence and perianth, × 20. 2 e. Male inflorescence, × 50. Drawn from the type.

the yellow-brown walls thickened, without trigones, the cuticle smooth. Underleaves absent. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, long, the bracts scarcely smaller than the leaves, similar, folded, concave, the bracteoles absent. Female inflorescence on a short branch, the bracts and bracteoles in 4–6 series, the outer series bifid to one-half their length, the inner series often quadrifid, the segments narrow. Perianth long [the mouth irregularly setulose and short-ciliate, very poorly preserved].

Pl. 94. Fig. 2, a–e.

Habitat: Unknown.

DOMINICA: s.l., *Elliott 2000* (♀) (lectotype G-608, 610); Lagona Flats, *Elliott 2100* (BM); Morne Diablotin, *Elliott 1995, 2117* p.p. (BM, G-613); Castle Bruce River, *Elliott 1682* (G-612); Morne Trois Pitons, *Elliott 2302* (BM, G-611).

REGREDICAULACEAE Fulford, fam. nov.

Cephaloziaceae auct. p.p.

Caules variabiles, ramis ventrali-intercalaribus, foliosis vel flagelliformibus. Rhizoidea ex amphigastriis. Folia succuba vel transversa, 1–2 filis vel laminis bi-, tri-, vel quadrifidis. Amphigastria reductissima, plerumque ex una serie (raro duabus) 2–4 cellularum adjacentium constata, cum vel sine 1–2 uniseriatis segmentis male formato. Inflorescentia masculina amentacea, in ramo ventrali vel in caule, bracteis bracteolisque foliiformibus. Inflorescentia feminea in ramo brevi ventrali, bracteis bracteolisque foliiformibus. Perianthium longum, tricarinatum supra.

Plants small, variable, the branches ventral-intercalary, axillary, leafy, or flagelliform or short and bearing a male or female inflorescence. Stems with 3–6 rows of cortical cells larger than the cells of the medulla. Rhizoids from the bases of the underleaves. Leaves succubous, or subtransverse to transverse, consisting of 1 or 2 short or long filaments, or having a lamina with 2, 3, or 4 segments. Underleaves of 1, rarely 2, rows of 2–4 rows of adjacent cells, with or without an occasional uniseriate segment. Male inflorescence catkin-like on the stem or on a short ventral branch, the foliaceous bracts and bracteoles like the underleaves. Female inflorescence on a short leafy branch, the bracts and bracteoles bifid to quadrifid to one-half or more. Perianth long, 3-keeled, the third keel ventral.

Type genus: *Regredicaulis* Fulford.

Regredicaulis Fulford, gen. nov.

Cephalozia auct. p.p.
Zoopsis auct. p.p.

Caules parvi, virides, variabiles, irregulariter ramosi; rami ventrali-intercalares, foliosi, vel longe flagelliformes, vel parvo foliosi; caulis aliquantum complanatus, cortex 4–6 cellulis magnis medullaque 1–3 vel 6–9 cellulis parvis. Rhizoidea ex amphigastriis. Folia oblique inserta, succuba, subquadrata, bifida, brevibus segmentis vel 1–2 cellularis. Amphigastria male formata, plerumque una serie 2–4 cellularum adjacentium. Inflorescentia masculina amentacea, in ramo longo ventrali vel in caule. Inflorescentia feminea in ramo brevi ventrali, bracteis bracteolisque in 3–4 seriebus, bifidis. Perianthium longum, tricarinatum supra, ore 6 laciniis longis.

Plants small, green, highly variable, in patches or among other bryophytes. Stems to 1 cm or more long, irregularly branched, the branches ventral-intercalary, leafy or variously flagelliform; stem in transverse section of a layer of 3–6 rows of large cortical cells surrounding a medulla of 1–9 smaller cells. Rhizoids from the bases of the underleaves and the base of the female inflorescence. Line of leaf insertion oblique. Leaves subquadrate, bifid (in *R. serrus*), or of only 1 cell and the slime papilla (in *R. monodactylus*), patent. Underleaves of 2–4 adjacent cells across the stem, occasionally of 2 rows and now and then a slime papilla. Plants dioicous and monoicous. Male inflorescence terminal becoming intercalary on the stem or branch, catkin-like, the bifid bracts and the bracteoles in many series. Female inflorescence on a short leafy branch, the bracts and bracteoles in 2 or 3 series, the bracts bifid, the segments acuminate. Perianth cylindrical below, 3-keeled above, the mouth of 6 long lacineae.

Type species: *Cephalozia serra* Spruce, 1882.

Key to the Species

Plants tiny; leaf 1-, rarely 2-celled, capped with a slime papilla; underleaves 2 cells wide. 2. *R. monodactylus.*

Plants larger; leaf cephalozoid, of many cells, bifid with triangular segments; underleaves mostly 4 cells wide. 1. *R. serrus.*

1. **Regredicaulis serrus** (Spruce) Fulford, comb. nov.

Cephalozia Subg. V *Eucephalozia, serra* Spruce, On *Cephalozia* 32. 1882.
Zoopsidella serra (Spruce) Schuster, Nova Hedwigia **10**: 30, 41. 1965. Non rite public.
Alobiella serra Schuster, Nova Hedwigia **10**: 29. 1965. Non rite public.

Plants small, pale green, in mats or among other bryophytes; stems turgid, 1–2 cm long, robust stems with leaves to 0.5 mm wide, irregularly branched; branches ventral-intercalary in the axils of underleaves, either very slender flagelliform with 3 rows of cortical cells and 2 or 3 rows of 1-celled leaves; or the stems larger, with 2 rows of dorsal cortical cells between the two rows of 1- or 2-celled leaves and a row of underleaves, suggesting *R. monodactylus*; or thicker, stolon-like with 3 rows or tufts of rhizoids, or semi-flagelliform with small leaves or leaves with one segment; or thick, flagelliform soon becoming leafy; stem showing 2 dorsal rows of large cortical cells between the 2 rows of leaves, in transverse section somewhat flattened, with a cortical layer of 6 large cortical cells (2 + 2 lateral, 2 ventral), and a medulla of 5 or 6 small cells. Rhizoids long or short, bulbous at the tip, from small cells of the base of the underleaves and from the base of the female inflorescence. Line of leaf insertion oblique, the leaves rarely becoming sublongitudinal. Leaves distant to approximate, spreading, ovate-quadrate, bifid to one-third their length or rarely retuse, crenulate, the segments straight, triangular from a 2- or 3-celled base; cells of the base of the segment 26–35 × 26–35 μ, the walls uniformly thickened, the cuticle verruculose. Underleaves reduced to a row of 2–4 cells across the stem, rarely 2 rows, a cell sometimes dividing to form a rhizoid initial. Plants dioicous. Male inflorescence on the stem or a leafy branch, long catkin-like, the bracts and bracteoles in 10 to many series, the bracts bifid, like the leaves, smaller, monandrous, the bracteoles like the underleaves. Female inflorescence on a short leafy ventral branch, the bracts and bracteoles in three series, the inner series the largest, the bracts bifid, the segments long triangular, acuminate. Perianth long, cylindrical below, 3-keeled above, the mouth of 6 long acuminate, often ciliate, laciniae. Sporophyte capsule dark brown, ovoid.

Pl. 95. Fig. 1, a–n.

Habitat: On wood in humid forest.

BRAZIL: Silva Amazonica: Fl. Uaupés, *Spruce*, *Hep. Spruc.* (type MANCH, isotypes BM, G, NY); cataracts, Rio Negro, *Spruce*, *Hep. Spruc.* (MANCH); S. Gabriel et Panuré, *Spruce*, *Hep. Spruc.* (G-13418, NY).

2. **Regredicaulis monodactylus** (Spruce) Fulford, comb. nov.

Cephalozia Subg. III *Zoopsis, monodactyla* Spruce, On *Cephalozia* 28. 1882.
Zoopsis monodactyla (Spruce) Stephani, Spec. Hep. **3**: 282. 1908.
Arachniopsis Subg. *Monodactylopsis*, *monodactyla* (Spruce) Schuster, Nova Hedwigia **10**: 30. 1965.

Plants tiny, confervoid, whitish-green, in small patches or among other bryophytes. Stems 0.5–1 cm long, somewhat flattened, with 2 rows of cortical cells between the opposite rows of leaves, in transverse sections of 3–4 rows of cortical cells (1 + 1 lateral, 1 ventral), and one or a few medullary cells; branches frequent, ventral-intercalary, axillary, leafy or flagelliform, or short with male and female inflorescences. Rhizoids few, from small cells of the bases of the underleaves. Leaves patent, of a single cell, rarely 2, the cell inflated-ovoid to cylindrical, capped with a

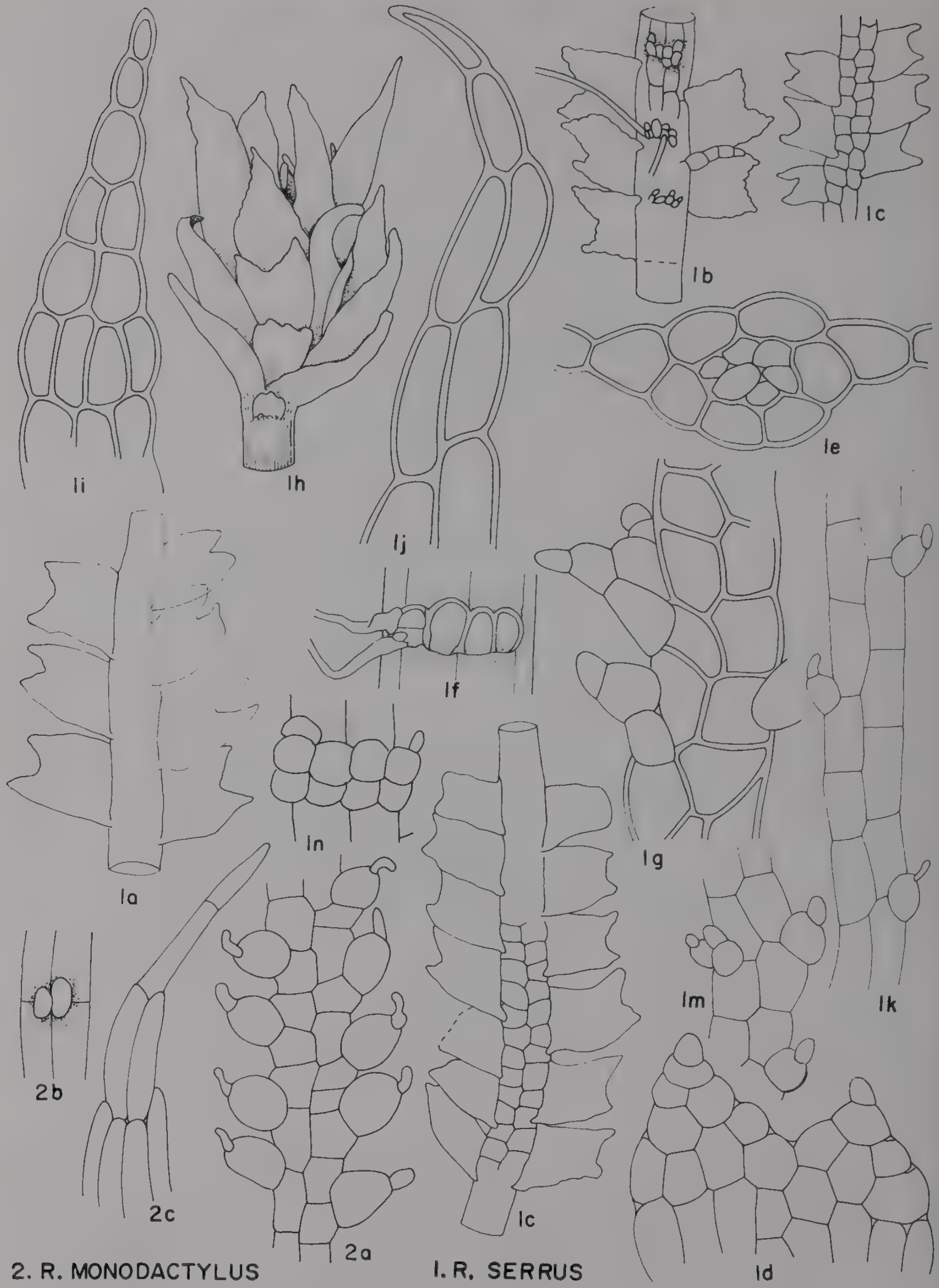
1i
1h
1j
1b
1c
1e
1a
1f
1n
1g
1k
1m
2b
2c
2a
1c
1d
2. R. MONODACTYLUS
1. R. SERRUS

Plate 95

FIG. 1. *Regredicaulis serrus*. 1 a. Stem, dorsal view, × 70. 1 b. Stem, ventral view, with underleaves and rhizoids, × 70. 1 c. Less well developed stems, × 70. 1 d. Leaf, × 200. 1 e. Transverse section of a stem, × 200. 1 f. Underleaf and rhizoids, × 200. 1 g. Atypical stem with reduced leaves, × 200. 1 h. Female inflorescence showing bracts and well-formed bracteoles, × 70. 1 i. Tip of a segment of a female bract, innermost series, × 200. 1 j. Tip of one of the six segments of the perianth mouth, × 200. 1 k. "Flagelliform" branch, showing a reversion, × 200. 1 m.

slime papilla not parallel to the margin; cell-wall thin, the cuticle smooth. Underleaves of 2 adjacent cells, which may cut off rhizoid initials at the base. Plants monoicous. Male inflorescence terminal or becoming intercalary on the stem or a leafy branch, the bracts and bracteoles in up to 10 series, the bracts bifid, with a lamina 4–6 cells wide, the bracteoles like the underleaves. Female inflorescence on a short leafy branch, the bracts and bracteoles foliaceous, in 2 or 3 series, long, bifid to one-half their length, the segments subulate. Perianth long, cylindrical below, 3-keeled above, the mouth of 6 slender lacineae.

Pl. 95. Fig. 2, a–c.

Habitat: On compact soil and on decaying wood in humid forests.

PUERTO RICO: La Juanita, near Las Marias, *E. G. Britton 3992* (NY).
BRAZIL: S. Gabriel, *Spruce, Hep. Spruc.* (NY); fl. Negro, cataracts, *Spruce, Hep. Spruc.* (isotype NY); S. Gabriel and Panuré, *Spruce, Hep. Spruc.* (BM, G-13418, NY).

Arachniopsis Spruce, On *Cephalozia* 84. 1882.

Plants very small, confervoid, whitish, yellowish or bluish green; stems thread-like, 1–3 cm long, sometimes becoming flagelliform at the tips, often branched; branches ventral-intercalary, in the axils of the underleaves, leafy or more rarely flagelliform, or short leafy and bearing a female or occasionally a male inflorescence. Rhizoids slender, from the cells of the underleaves. Line of leaf insertion subtransverse or oblique with the leaves succubous. Leaves of one or a pair of filiform, uniseriate segments 4–6 or more cells long, the tip cell short. Underleaves usually of 2 adjacent cells capped with slime papillae. Plants monoicous and dioicous. Male inflorescence terminal on a stem or leafy branch, the bracts similar to the leaves, monandrous, the bracteoles similar to the underleaves. Female inflorescence terminal on a short branch, the bracts and bracteoles in 3–5 series, with a lamina and long segments, the outer series bifid, the inner series largest, quadrifid. Perianth cylindrical below, with 3 rounded keels above, the mouth laciniate with 12 long lacineae. Regeneration from the tip or upper cells of the leaf. Sporophyte not seen.

Type species: lectotype *Jungermannia diacantha* Montagne, 1856.

Key to the Species

1. All leaves of a plant of 1 row of 3–5 cells. 3. *A. pecten.*
1. Leaves of a pair of uniseriate segments free to the base (here and there only one segment may develop).
    2. The pair of leaf segments flattened, parallel, one above the other. 4. *A. dissotricha.*
    2. Segments of a pair arising at almost the same level, widely spreading, slender, 6–10 cells long.
        3. Leaf segments mostly flaccid; cells 78–90 μ × 20–26 μ. 2. *A. coactilis.*
        3. Leaf segments often stiff and bristle-like; cells mostly 130 × 20 μ. 1. *A. diacantha.*

1. **Arachniopsis diacantha** (Montagne) Howe, Bull. Torrey Club. **29**: 288. 1902.

Jungermannia diacantha Montagne, Ann. Sci. Nat. IV. Bot. **5**: 349. 1856.
Arachniopsis coactilis var. *capillacea* Spruce, On *Cephalozia* 85. 1882.
Arachniopsis capillacea Spruce, ms. *Hep. Spruc.*

Portion of a "flagelliform" branch, a reversion similar to the adult stage of *R. monodactylus*, × 200. 1 n. Underleaf with two rows of cells, × 200. Drawn from isotypes, *Spruce, Hep. Spruc.* (NY).

FIG. 2. *R. monodactylus*. 2 a. Stem, dorsal view, × 200. 2 b. Underleaf on a stem, × 200. 2 c. Tip of a perianth segment. Drawn from an isotype, *Spruce, Hep. Spruc.* (NY).

Plants very small, confervoid, in whitish- or yellowish-green mats or over other bryophytes. Stems to 2, rarely to 3 cm long, irregularly branched, the branches ventral-intercalary, axillary, long, leafy, or short and bearing a female inflorescence. Rhizoids from the basal cells of the underleaves, short, slender, branched at the tips. Line of leaf insertion appearing transverse. Leaves bifid to the base, the 2 long segments often stiff, bristle-like, widely spreading, 5–8 cells long with a very short tip cell, or occasionally in the upper part of the stem the leaf of only 1 segment; cells of the segment mostly 130 × 20 μ, the tip cell 13–15 μ long, the walls uniformly thickened, the cuticle smooth. Underleaves very small, of two adjacent cells, each capped with a slime papilla. Male and female inflorescences and sporophyte not seen.

Pl. 96. Fig. 1, a–d.

Habitat: Unknown.

TRINIDAD: summit of Mt. Aripo, 3000 ft, *Simmonds 177* p.p. (MICH).

PERU: s.l., *Weddell* (type PC); Monte Campana, 1200 m, *Spruce*, *Hep. Spruc.*, type of *A. coactilis* var. *capillacea* (isotypes G, NY).

2. **Arachniopsis coactilis** Spruce, On *Cephalozia* 85. 1882.

Arachniopsis filifolia Spruce, ms. *Hep. Spruc.*
Arachniopsis coactilis var. *filifolia* Spruce, On *Cephalozia* 85. 1882.
Arachniopsis filifolia Spruce, ms. *Hep. Spruc.*

Plants small, confervoid, in whitish- to yellowish-green mats or over other bryophytes. Stems to 3 cm long, irregularly branched, the branches ventral-intercalary, axillary, leafy, often becoming flagelliform in part, or short leafy and bearing a female inflorescence. Rhizoids short, slender, hyaline, branched at the tips, abundant from the cells of the underleaves and the regenerant cells of the leaf tips. Leaf insertion transverse. Leaves bifid to the base, the uniseriate segments filiform, 6–8 or 10 cells long, widely spreading, flexible and curved, capped with a small oval cell; cells mostly 78–90 × 20–26 μ, the tip cell tiny, the walls uniformly thickened, the cuticle smooth. Underleaves small, of 2 adjacent rounded cells, each with an elongate erect slime papilla above. Plants monoicous and dioicous. Male inflorescence terminal becoming intercalary on a stem or branch, the bracts and bracteoles compact, in many series, the bracts long, bifid to the base, erect-spreading, the bracteoles similar to the underleaves. Female inflorescence on a short leafy branch, the bracts and bracteoles in 3 or 4 series, with a lamina 1 to 3 rows of cells high, the outer series bifid or trifid, the inner series largest, quadrifid, the segments long, 2 cells wide below. Perianth long, cylindrical below, with 3 broad keels above, the mouth ciliate-laciniate, the long cilia of many long cells. Regeneration from the tip cell or from small cells cut off from near the tip of the leaf segment; rhizoids abundant before these become detached. Sporophyte not seen.

Pl. 96. Fig. 2, a–k.

Habitat: On decayed logs, over humus, rocks, on tree bases and trunks or among other bryophytes in humid forests.

COLOMBIA: Amazonas: Río Caquetá, La Pedrera, *Schultes & Cabrera 17818* p.p. (FH); Vaupés: Rio Papure, Teresita, *Schultes & Cabrera 19456* (FH); Río Paca, Wacaricuara, 650 ft, *Schultes & Cabrera 19506* p.p. (FH).

VENEZUELA: Amazonas: Serrania Parú, Caño Asisa, Río Ventuarí, 2000 m, *Cowan & Wurdack 31321* p.p. (NY); Cerro Huachamacari, Río Cunucunuma, Caño de Dios, 1800 m, *Cowan, Wurdack & Maguire 30269* p.p. (NY); same locailty, near "Camp II," 1200 m, *Cowan, Wurdack & Maguire 29905* p.p. (NY).

BRAZIL: Panuré, fl. Uaupés, *Spruce, Hep. Spruc.* (G-13410, NY); San Carlos del Rio Negro, *Spruce, Hep. Spruc.* (isotype NY); Fl. Negro et Uaupés, *Spruce, Hep. Spruc.*, type of *A. filifolia* (isotypes NY, G-13414).

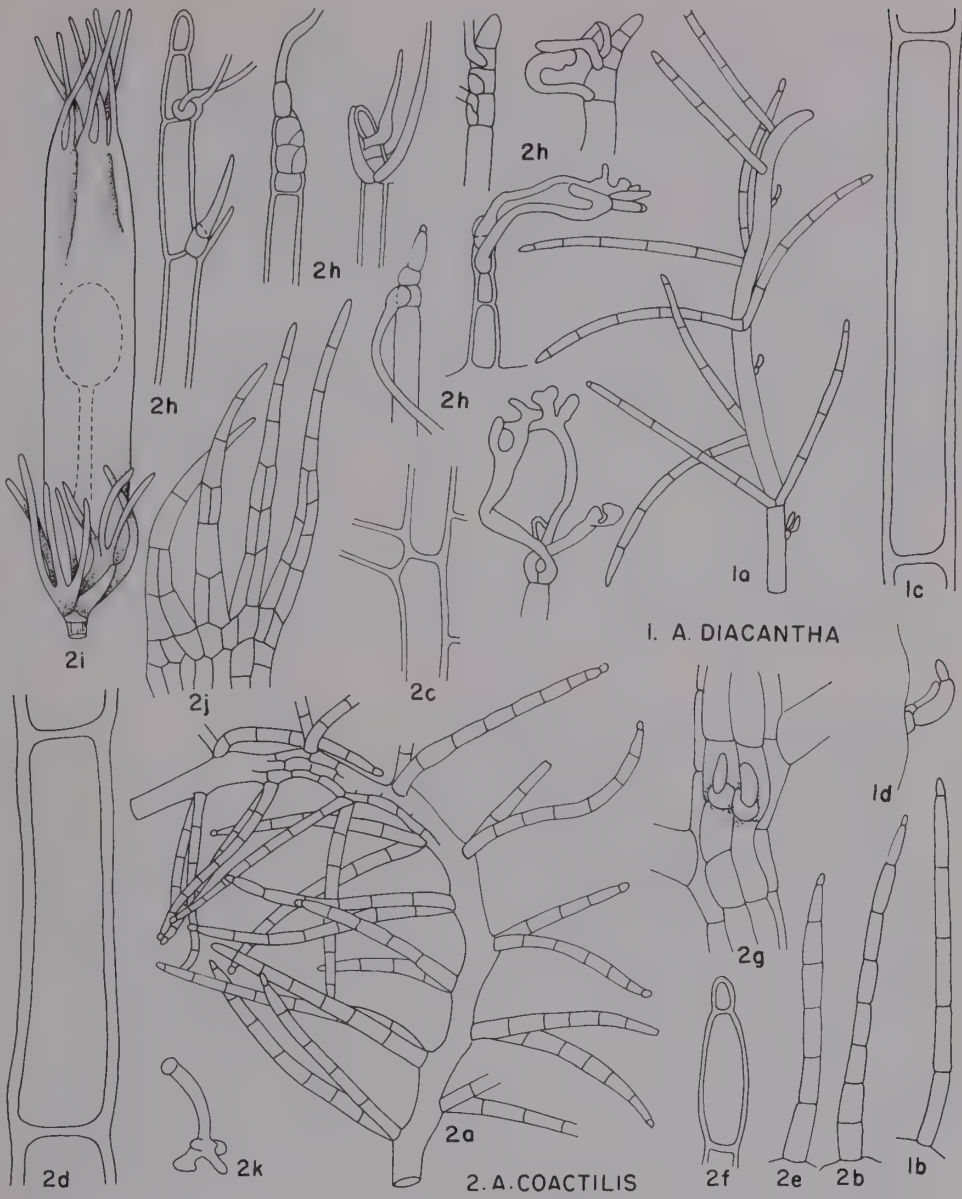

Plate 96

FIG. 1. *Arachniopsis diacantha*. 1 a. Portion of a stem, lateral view, × 70. 1 b. One segment of a leaf, × 70. 1 c. Leaf cell, × 500. 1 d. Profile of an underleaf, × 200. Drawn from an isotype of *A. capillaris*, Spruce (NY).

FIG. 2. *A. coactilis*. 2 a. Portion of a plant, dorsal view, × 50. 2 b. One segment of a leaf, × 70. 2 c. Leaf attachment on the stem, × 200. 2 d. Leaf cell from the middle of a segment, × 500. 2 e. One leaf segment, × 70. 2 f. Tip of leaf segment, × 500. 2 g. Stem and underleaf, × 200. 2 h. Examples of regeneration from cells of the upper part of the leaf segment, × 200. 2 i. Female inflorescence and perianth. 2 j. Female bract, inner series. 2 k. Rhizoid, × 200. Fig. 2 a–d, g, k, from an isotype of *A. coactilis* (NY); 2 e, f, from an isotype of *A. filiformis* (NY); 2i, j, after Spruce, 1885; 2 h, from several collections from Venezuela and Brazil.

3. **Arachniopsis pecten** Spruce, On *Cephalozia* 85. 1882.

Arachniopsis (*Monodactylopsis*) *minima* Schuster, Nova Hedwigia **10**: 24. 1965.

Plants hair-like, bluish-green or yellowish-green, in mats or over other bryophytes; stems 1–2 cm long, the frequent branches ventral-intercalary, axillary, long, leafy or short and bearing a male or female inflorescence; stem in transverse section of 6 rows of cortical cells and 1 row of smaller cells in the medulla. Rhizoids scarce, very slender, from cells of the underleaves. Leaf insertion "transverse." Leaves 0.5–0.7 mm long, of 1 row of 3–5 cells, the basal cell 52–84 × 15–20 μ, the small tip cell to 15 μ long, the walls uniformly thickened, the cuticle smooth. Underleaves small, of two adjacent cells, each bearing a slime papilla. Plants dioicous. Male inflorescence terminal becoming intercalary on a stem or long branch, the bracts bifid to the base, erect-spreading, the bracteoles like the underleaves. Female inflorescence terminal on a short leafy branch, the bracts and bracteoles in 3 or 4 series, the inner series longest, these bracts with a short lamina and 3 or 4 long segments. Perianth cylindrical below, with 3 broad keels above, the mouth long ciliate-laciniate, with 12 long cilia.

Pl. 97. Fig. 3, a–e.

Habitat: On soil over tree roots, along rivers in forests [selva].

VENEZUELA: Terra Amazonas: selva . . . Casiquiare, *Vareschi 7799* (VEN).

BRAZIL: Silva Amazonica: flumen Uaupés, *Spruce*, *Hep. Spruc.* (isotypes NY, G-13415); San Gabriel and San Carlos, *Spruce*, *Hep. Spruc.*, isotype of *A. minima* [with *Pteropsiella frondiformis*] (NY).

4. **Arachniopsis dissotricha** Spruce, On *Cephalozia* 86. 1882.

Plants small, yellowish to dark green, in dense mats. Stems prostrate, to 2 cm or more long, flattened, with leaves to 0.8 mm broad, often tending to become flagelliform toward the tip, irregularly branched; branches frequent, ventral-intercalary, axillary, leafy or tending to become flagelliform, or short and bearing a female inflorescence. Rhizoids slender, from the cells of the underleaves. Leaf insertion oblique, the leaves succubous. Leaves of 2 widely spreading to patent segments, often tending to be ascendant, flattened, the parallel, approximate, uniseriate segments to 0.4 mm long, of 4 cells, the basal cell to 130 μ long, 39 μ wide, the small, oval tip cell to 26 μ long, the walls uniformly thick, the cuticle verruculose. Underleaves of 2 small adjacent cells, each capped with a slime papilla. Plants dioicous. Male inflorescence terminal becoming intercalary on a stem or branch, the bracts in many series, like the leaves, but erect spreading and pouched at the base, the bracteoles scarcely larger than the underleaves. Female inflorescence on a short branch, the bracts and bracteoles in 3 or 4 series, the outer series bifid or trifid from a lamina 1 or 2 cells high, the inner series largest, quadrifid from a lamina 2 or 3 cells high, the segments long. Perianth cylindrical below, with 3 broad keels above, the mouth long-ciliate laciniate, the cells of the long cilia 90–100 μ long.

Pl. 97. Fig. 4, a–d.

Habitat: Over soil on tree roots in forests.

BRAZIL: Silva Amazonica: Flumen Uaupés, *Spruce*, *Hep. Spruc.* (isotypes NY, G-13413); prope Panuré, *Spruce 2905*, *2944* (NY).

PERU: Tarapoto, Río Mayo, *Spruce 4736* (NY).

Odontoseries Fulford, gen. nov.

Caules brunnei, ramis ventrali-intercalaribus, foliosis; caulium cortex 6–7 cellulis magnis, cellulis ventralibus parvioribus, medullaque 8–10 cellulis. Rhizoidea ex

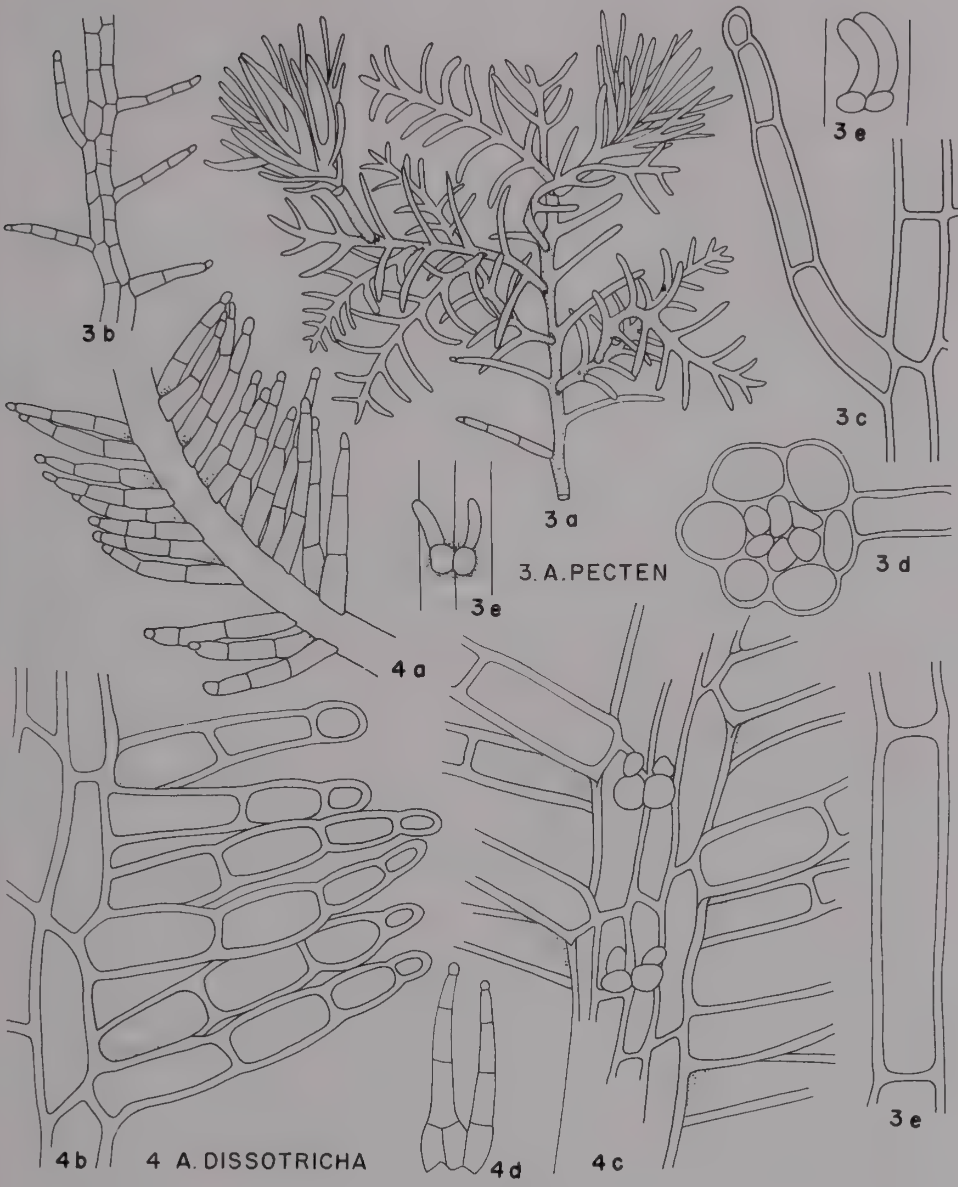
3 a
3 b
3 c
3 d
3 e
3 e
3 e
3. A. PECTEN
4 a
4 b
4 c
4 d
4 A. DISSOTRICHA

Plate 97

FIG. 3. *Arachniopsis pecten.* 3 a. Plant, ventral view. 3 b. Stem, dorsal view, × 70. 3 c. Leaf insertion on the stem, × 275. 3 d. Transverse section of the stem, × 200. 3 e. Underleaves on a stem, × 200. Fig. 3 a, after *Spruce*, 1885; fig. 3 b–e, from an isotype (NY).

FIG. 4. *A. dissotricha.* 4 a. Stem, dorsal view, × 70. 4 b. Leaf insertion on the stem, × 200. 4 c. Stem and underleaves, ventral view, × 200. 4 d. Female bracteole, × 400. Drawn from an isotype (NY).

amphigastriis. Folia sublongitudinaliter inserta, succuba, bi-, tri-, vel quadrifida ad medium, segmentis uniseriatis, fragilibus. Amphigastria variabilia, diminuta, plerumque seriebus 4 cellularum adjacentium, 1–2 uniseriatis segmento male formato. Inflorescentiae non visae.

Type species: *O. chimantana* Fulford.

Odontoseries chimantana Fulford, sp. nov.

Folia brunnea, sublongitudinaliter insertis, bi-, tri-, vel quadrifida ad medium, segmentis uniseriatis, plerumque fragilibus vel caducis; amphigastria ex una serie, 4-cellularum adjacentium constata, 1–2 uniseriatis segmento male formato.

Plants of medium size, brown, over *Sphagnum*; stems 1–3 cm long, with leaves to 1 mm broad, rarely branched; branches ventral-intercalary, in the axils of the underleaves, leafy or flagelliform; stems somewhat flattened, with 2 (rarely 3) rows of elongate, dorsal cortical cells between the 2 rows of leaves; in transverse section, of a cortical layer of 6–7 rows of large cells (2 + 2 lateral, 2 smaller ventral), surrounding the medulla of 6–8 smaller cells. Rhizoids from the underleaves. Line of leaf insertion oblique, sublongitudinal. Leaves rectangular in outline, spreading, decurrent, bi-, tri-, or quadrifid to near the middle, the segments uniseriate from a 2-celled base, fragile soon falling; cells of the lamina tending to be in rows, 52–104 × 52 μ, the walls uniformly thickened, the cuticle faintly verruculose. Underleaves reduced, of usually 4 adjacent cells across the stem, and one or two poorly formed, 1- to 3- celled uniseriate segments from the outer cells. Male and female inflorescences not seen.

Pl. 98. Fig. 1, a–i.

Habitat: Damp bluffs of falls.

VENEZUELA: Bolívar: Chimantá Massif, Torono-tepuí, Caño Mojado, 1910–1970 m, *Steyermark & Wurdack 970* (type), *971* p.p., *972* p.p., *973* p.p. (NY).

ZOOPSIDACEAE Nakai [A list of Professor Makai's papers . . . science] 199. 1943.

Cephaloziaceae auct. p.p.

Plants leafy, or thallose with unistratose wings; stem or axis somewhat flattened, with 2 rows of cells on the dorsal side, in transverse section with a cortical layer of 6–8 large cells surrounding the medulla of small cells; branches lateral, of the *Frullania* type (infrequent to rare), most commonly ventral-intercalary, axillary, leafy, or thallose in *Pteropsiella*, or sometimes flagelliform, or short with few leaves and bearing a male or female inflorescence. Rhizoids short, hyaline with enlarged tips, from small cells from the underleaves. Line of leaf insertion oblique, nearly longitudinal, the leaves succubous. Leaves ovate, unequally bifid or subquadrate to rectangular, bearing 2 long, crescent-shaped "slime" papillae aligned parallel to the margin of the thallus. Underleaves of a transverse row of 2–8 cells usually capped with slime papillae. Plants monoicous or dioicous. Male inflorescence terminal on the axis or a shorter branch, often becoming intercalary, the bracts in 6–12 series, foliaceous, bifid, the bracteoles like the underleaves. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, foliaceous, the innermost series largest, bifid. Perianth cylindrical below, 3-keeled above, the mouth of usually 6 long laciniae. Shoot-sporophyte relationship a shoot-calyptra. Capsule oval, brown, the wall of 2 layers of cells. Seta in transverse section of 8 outer rows and 4 smaller inner rows of cells.

Type genus: *Zoopsis* Hooker f. & Taylor, 1844.

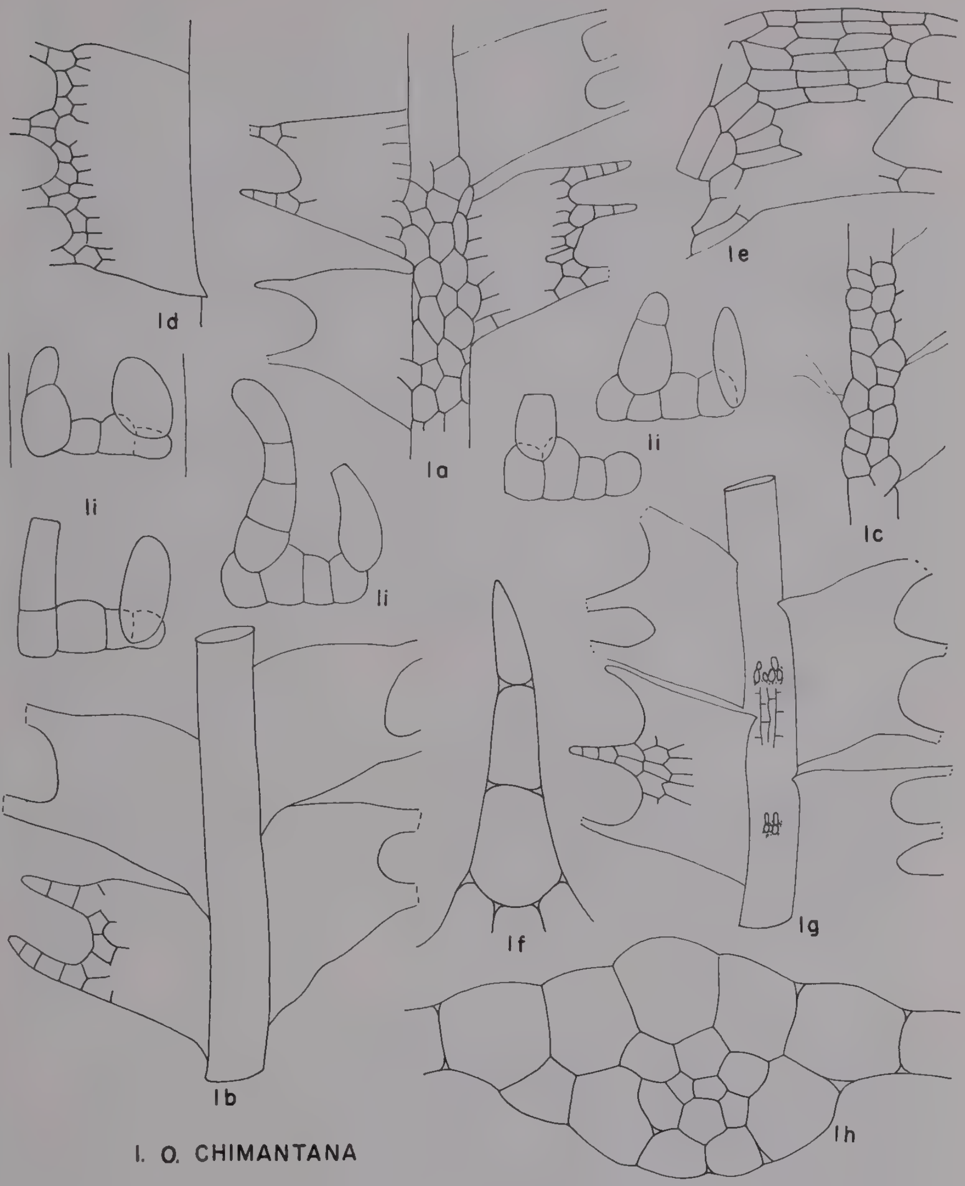

Plate 98

FIG. 1. *Odontoseries chimantana*. 1 a. Stem with bifid and trifid leaves, dorsal view, × 40. 1 b. Stem with bifid leaves, dorsal view, × 40. 1 c. Portion of a small stem with two regular rows of dorsal cortical cells, × 40. 1 d. Quadrifid leaf, × 40. 1 e. Trifid leaf, × 50. 1 f. Tooth of a leaf, × 200. 1 g. Stem with underleaves, ventral view, × 40. 1 h. Transverse section of the stem, × 200. 1 i. Underleaves, × 100. Drawn from the type.

Zoopsis Hooker f. & Taylor in J. D. Hooker, Bot. Antarct. Voy. 1(1): 167. 1844 (1847).

Cephalozia Lindberg, p.p., Jour. Linn. Soc. Bot. **13**: 190. 1872.
Cephalozia Subg. III *Zoopsis* (Hooker f. & Taylor) Spruce, On *Cephalozia* 26. 1882.
Zoopsidella Schuster, Nova Hedwigia **10**: 24. 1965. p.p.

Plants small; stems thread-like, flattened, in transverse section of usually 6 rows of large cortical cells (2 + 2 lateral, 2 ventral), surrounding the cells of the medulla. Branches occasionally lateral of the *Frullania* type, more often ventral-intercalary in the axils of the underleaves, leafy, or shorter leafy and bearing a male or female inflorescence, or more rarely becoming flagelliform and more or less radial, with reduced leaves or scales. Rhizoids from small cells cut off from the base of the underleaves. Leaf insertion oblique, sublongitudinal. Leaves more or less bifid (in *Z. argentea* of only 2 cells), with 2 large, elongate, usually curved "slime" papillae at the tips of the segments, or along the margin in ovate leaves; cells with uniformly thickened walls, without trigones. Underleaves of 2 adjacent cells capped with slime papillae. Plants monoicous and dioicous. Male inflorescence long, terminal or becoming intercalary on a stem or branch, the bracts and bracteoles in many series, the bracts bifid, monandrous, the bracteoles like the underleaves. Antheridial stalk uniseriate. Female inflorescence relatively large, the bracts and bracteoles in usually 3 series, bifid. Archegonia few. Perianth cylindrical below, 3-keeled above, the mouth laciniate. Capsule brown, the wall of 2 layers of cells; seta in transverse section (where known) of 8 large outer cells and about 4 smaller inner cells.

Type species: *Jungermannia* (*Metzgeria*) *argentea* Hooker f. & Taylor, 1844. [Auckland Islands.]

Key to the Species

1. Leaves subquadrate; leaf cells subquadrate. 3. *Z antillana.*
1. Leaves ovate, undivided to distinctly bifid-trapezoidal; leaf cells longer than broad.
  2. Leaves mostly asymmetric ovate, the apex broad, rounded; plants dioicous. 1. *Z. integrifolia.*
  2. Leaves mostly trapezoidal; plants monoicous.
    3. The longer leaf segment broad, rounded above. 2. *Z. cynosurandra.*
    3. Leaf segments tapering to a point 2 cells broad. 4. *Z. macella.*

1. **Zoopsis integrifolia** (Spruce) Stephani, Spec. Hep. **3**: 284. 1908.

Cephalozia integrifolia Spruce, Jour. Bot. London **14**: 136. 1876.
Cephalozia Subg. IV *Alobiella, integrifolia* Spruce, On *Cephalozia* 29. 1882.
Zoopsidella integrifolia (Spruce) Schuster, Nova Hedwigia **10**: 42. 1965. non rite public.
Alobiella integrifolia Spruce, *Hep. Spruc.*, in Hb.

Plants small, light green to whitish, becoming yellowish on drying, in mats or scattered among other bryophytes; stems 2–4 cm long, with leaves to 1.3 mm wide, irregularly pinnate; branches frequent, ventral-intercalary, axillary, leafy or rarely flagelliform, or small-leaved, often bearing a male or female inflorescence; stems somewhat flattened, with 2 rows of dorsal cortical cells between the 2 rows of opposite leaves. Rhizoids hyaline, short, slender, with a bulbous tip, often abundant from small cells cut off from the underleaf base. Line of leaf insertion oblique, sublongitudinal. Leaves plane, spreading, tending to be ascendant, asymmetric-ovate when well developed, 0.5–0.65 mm long, 0.4–0.5 mm wide at the base, narrowed to the scarcely crenulate, rounded apex and capped with a long narrow papilla, the dorsal margin nearly straight, the ventral margin longer, convex, with the long, curved marginal papilla cell just above the middle; marginal papillae 117 × 13 μ, curved, cells of the upper part of the leaf mostly rectangular in outline, 65–70 × 26–39 μ, without trigones, the walls uniformly thickened, the cuticle smooth. Leaves often modified, broadly triangular on a flattened stem or in reduced or juvenile forms, the leaves as widely spaced 1-celled projections with a long slime papilla from a terete stem. Underleaves of 2 adjacent cells, these often divided, the 2 basal cells producing many rhizoid initials. Plants dioicous. Male inflorescence long, terminal becoming intercalary on a branch, the bracts in up to 10 series, the bracts bifid, monandrous, the bracteoles like the underleaves. Female inflorescence large, on a short leafy branch, the bracts and bracteoles in 2 or 3 series, deeply bifid, the segments subulate, entire. Perianth long, cylindrical below, 3-keeled above, the mouth of 6 long lacineae. Regeneration through numerous cell divisions in the cells of the upper margin of the leaf, with rhizoids formed from some of the new cells. No further stages were seen.

Pl. 99. Fig. 1, a–o.

Habitat: On soil, cliff faces, tree trunks and decaying logs in humid forests.

COLOMBIA: Río Papuri, Teresita, *Schultes & Cabrera 19456* p.p. (FH); Río Paca, Wacaricuare, 650 ft, *Schultes & Cabrera 19506, 19508* p.p. (FH); Río Apaporis, Cachivera de Jirijirimo, 250 ft, *Schultes & Cabrera 12400* p.p. (FH).

VENEZUELA: Chimantá Massif, Central Section, 1925 m, *Steyermark & Wurdack 314* p.p., 1940 m, *Steyermark & Wurdack 430* p.p., *431* (NY).

BRAZIL: Amazon, *Spruce* (NY); San Carlos, *Spruce* (NY); Panuré, *Spruce* [834] (NY); Silva Amazonica: Fl. Negro et Uaupés, *Spruce*, *Hep. Spruc.* (isotypes BM, NY). Amazonas, *Eiten 5181* (Hb Eiten); S. Paulo: Brasso Grande, Itapecirica, *Schiffner 1296* (UPS).

2. **Zoopsis cynosurandra** Spruce ex Stephani, Spec. Hep. **3**: 283. 1908.

Alobiella cynosurandra Spruce, ms. *Hep. Spruc.*, in Hb.
Zoopsidella cynosurandra (Spruce ex Stephani) Schuster, Nova Hedwigia **10**: 24. 1965.

Similar to *Z. integrifolia* but with the following differences: the ovate, nearly undivided leaf tends to be trapezoidal with the longer segment oblong-rounded; the cells of this segment are often somewhat longer and the plants are monoicous.

Pl. 100. Fig. 2, a–f.

Habitat: On decaying tree trunk.

BRAZIL: Fl. Negro et Uaupés, *Spruce*, *Hep. Spruc.* (isotypes BM, NY, G-13416).

3. **Zoopsis antillana** Stephani, Spec. Hep. **3**: 282. 1908.

Plants small in whitish- to yellowish-green mats or scattered among other bryophytes. Stems 1–3 cm long, with leaves 0.4–0.8 mm broad, occasionally branched; branches usually ventral-intercalary, axillary, very rarely lateral, of the *Frullania* type, leafy or short leafy and bearing a male or female inflorescence; stem somewhat flattened, with 2 rows of large cortical cells between the opposite rows of leaves, in transverse section of 6 large cortical cells surrounding a medulla of small cells. Rhizoids in small tufts from the bases of the underleaves, hyaline, short, the tip often bulbous. Line of leaf insertion sublongitudinal. Leaves plane, widely spreading, tending to be ascendant, mostly subquadrate with the broad apex straight or retuse, the 2 elongate papillae at the outer corners; cells of the upper part of the leaf large, tending to be isodiametric, 50–60 × 45–58 μ, the walls uniformly thickened, without trigones, the cuticle smooth. Underleaves usually of 2 adjacent cells with small, rhizoid-bearing cells below. Plants monoicous. Male inflorescence terminal or becoming intercalary on a branch, the bifid bracts and the bracteoles in to 10 series. Female inflorescence on a short leafy branch, the bracts and bracteoles in 3 or 4

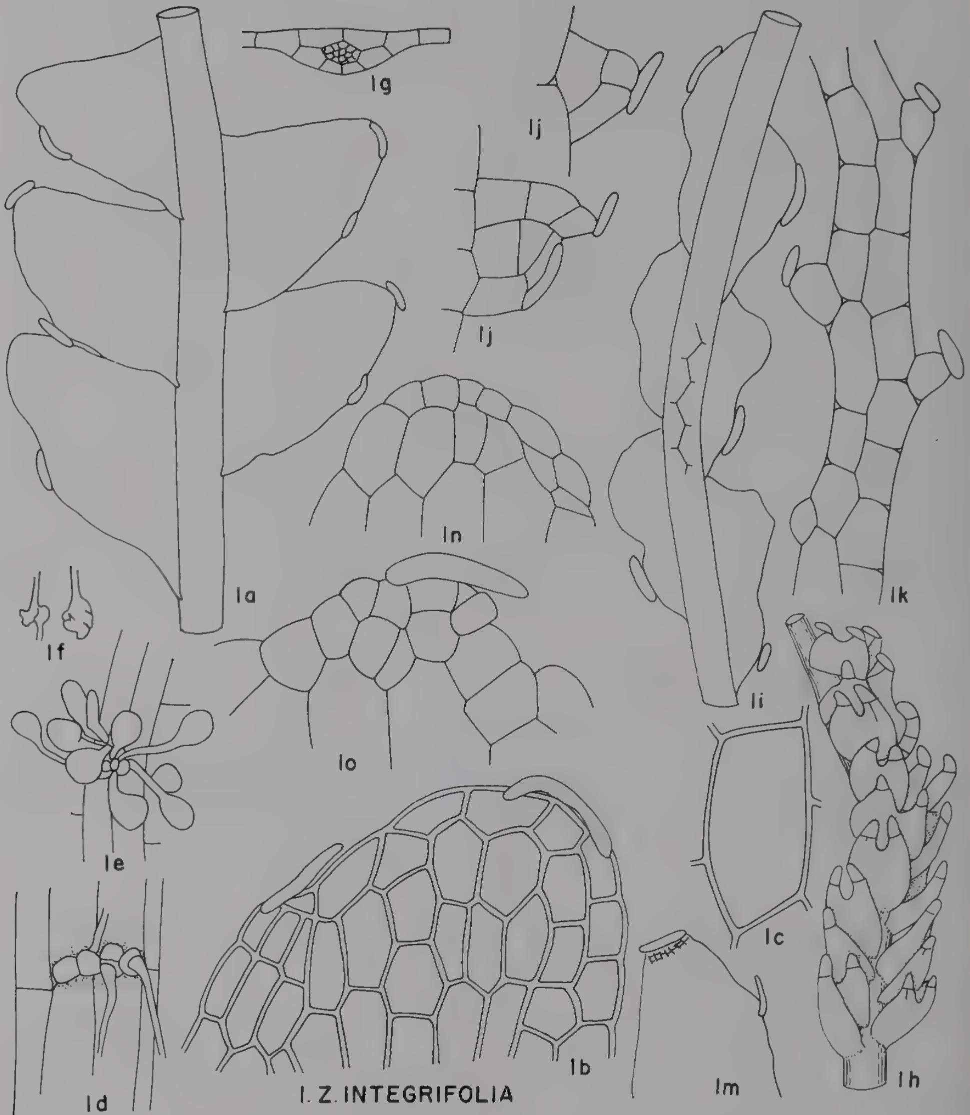

Plate 99

FIG. 1. *Zoopsis integrifolia.* 1 a. Stem, dorsal view, × 50. 1 b. Upper part of a leaf with the two elongate marginal papillae, × 200. 1 c. Cell from the upper part of a leaf, × 500. 1 d. Underleaf with rhizoids, × 200. 1 e. Short rhizoids with bulbous tips from an underleaf, × 200. 1 f. Tips of rhizoids, × 200. 1 g. Transverse section of a stem. 1 h. Male inflorescence, × 50. 1 i. Stem with reduced leaves, × 70. 1 j. Two reduced leaves, × 200. 1 k. Cylindrical stem with leaves of only one cell and a large terminal papilla, × 200. 1 m. Leaf showing area of regeneration at the tip, × 50. 1 n, o. Leaf tips showing details of the area of regeneration, × 200. Fig. 1 a–e, m, o, from the type; 1 f, i–k, n, from Venezuela, *Schultes & Cabrera 19456*; 1 g, after Stephani, Icones; 1 h, from Colombia, *Steyermark & Wurdack 430* p.p.

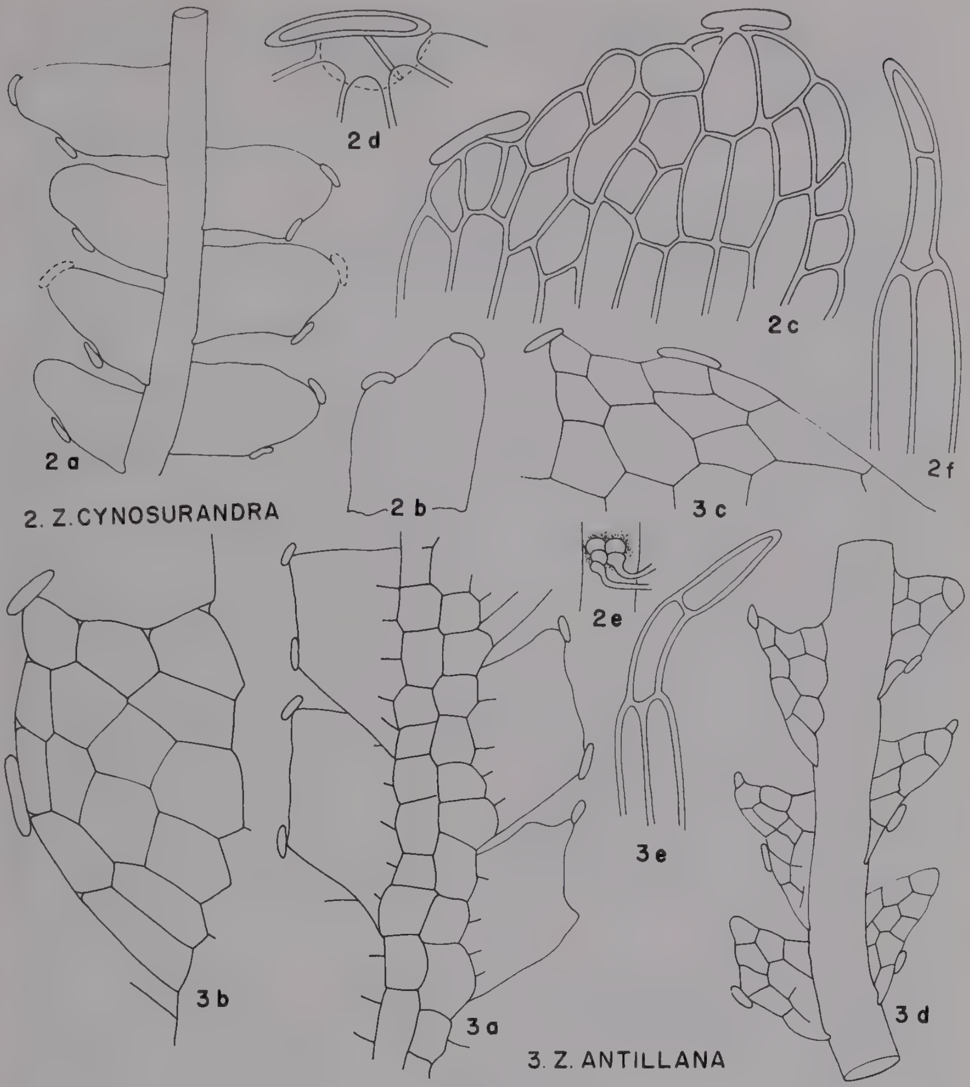

Plate 100

FIG. 2. *Zoopsis cynosurandra*. 2 a. Stem, dorsal view, × 50. 2 b. Leaf, × 50. 2 c. Upper part of a leaf, × 200. 2 d. Papilla on the tip of the leaf lobe, × 200. 2 e. Underleaf with rhizoids, × 200. 2 f. Tip of a perianth segment, × 200. Drawn from the type.

FIG. 3. *Z. antillana*. 3 a. Stem, dorsal view, × 50. 3 b. Leaf, × 150. 3 c. Small leaf, × 150. 3 d. Depauperate stem with triangular leaves, × 70. 3 e. Tip of a female bract segment, × 200. Drawn from *Elliott 2285*.

series, large, bifid, the segments long. Perianth long, cylindrical below, 3-keeled above, the mouth laciniate.

Pl. 100. Fig. 3, a–e.

Habitat: On decaying logs or moist sandy soil in humid, shaded areas.

CUBA: Isle of Pines: Los Indios, *Britton, Britton & Wilson 14259* (NY); Moa Region, *Webster 849* (MICH).

PUERTO RICO: Luquillo Mountains: lower slopes of Mt. Britton, *Fulford, Crandall & Stotler 619* p.p., *620* p.p. (Hb Fulford); Cataline-Yunque Trail, *E. G. Britton 7722* (NY).

DOMINICA: Morne Trois Pitons, *Elliott 2285* p.p. [type (?) BM].

WEST INDIES: s.l., *Breutel* (NY).

TRINIDAD: Aripo Savanna, *E. G. Britton, Coker & Rowland 342, 343,* 347 (NY); e of Arima, *E. G. Britton, Coker & Rowland 637* (NY); s.l., *Fendler* (♂, ♀) (NY).

4. **Zoopsis macella** (Spruce) Fulford, comb. nov.

Cephalozia Subg. IV *Alobiella, macella* Spruce, On *Cephalozia* 29. 1882.
Alobiella macella (Spruce) Stephani, Spec. Hep. **3**: 354. 1908.
Zoopsidella macella (Spruce) Schuster, Nova Hedwigia **10**: 42. 1965. Non rite public.

Plants small, in whitish to light green or yellowish patches or among other bryophytes. Stems 1–3 cm long, with leaves, to 0.5–0.8 mm broad, occasionally branched, the branches ventral-intercalary, axillary, leafy or occasionally with a male or female inflorescence; stem somewhat flattened, with 2 conspicuous rows of dorsal cortical cells between the leaves. Rhizoids scarce, from small cells at the bases of the underleaves. Line of leaf insertion sublongitudinal. Leaves plane, widely spreading, tending to be trapezoidal in outline, the longer segment always triangular and ending in a tip 2 cells wide, the 2 large elongate terminal papillae usually present; cells of the upper part of the leaf mostly 39–52 × 26–35 μ, the walls uniformly thickened, without trigones, the cuticle smooth. Underleaves mostly of 2 adjacent cells or, when bearing rhizoids, of many tiny cells. Plants monoicous. Male inflorescence long, terminal or becoming intercalary on a branch, the bifid bracts and the bracteoles in 7–12 series. Female inflorescence on a short ventral branch with few leaves, the bracts and bracteoles larger than the leaves, deeply bifid, the segments long-acute. Perianth long, cylindrical below, 3-keeled above, the mouth long laciniate-ciliate.

Pl. 101. Fig. 4, a–e.

Habitat: On decaying wood in humid forests.

BRAZIL: Silva Amazonica: Santarem, *Spruce, Hep. Spruc.* (type MANCH; isotypes BM, G, NY).

The following taxa of *Zoopsis* have not been studied:

Zoopsis martinicensis Stephani, 1908. Martinique.
Zoopsis uleana Stephani, 1905. Brazil.

Reference

Schuster, R. M. 1965. Studies on Hepaticae XXVI. The *Bonneria- Paracromastigum-Pseudocephalozia-Hyalolepidozia-Zoopsis-Pteropsiella* complex and its allies: a phylogenetic study (Part 1). Nova Hedwigia **10**: 19–61.[9]

Pteropsiella Spruce, Jour. Bot. London **14**: 161. 1876.

Cephalozia Subg. II *Pteropsiella* Spruce, On *Cephalozia* 24. 1882.

Vegetative plant a small green thallus of the facies of *Pallavicinia* or *Symphyogyna,* the axis or "midrib" flattened dorsally with 2 rows of large cortical cells between the unistratose wings; wings broad, bearing very long slime papillae lying parallel to the margin, occasionally the axis becoming wingless, flagelliform; axis in transverse section of a cortical band of 8 cortical rows (2 dorsal, 2 with wings

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[9] This reference also relates to most of the genera and some of the species in the remainder of Part III.

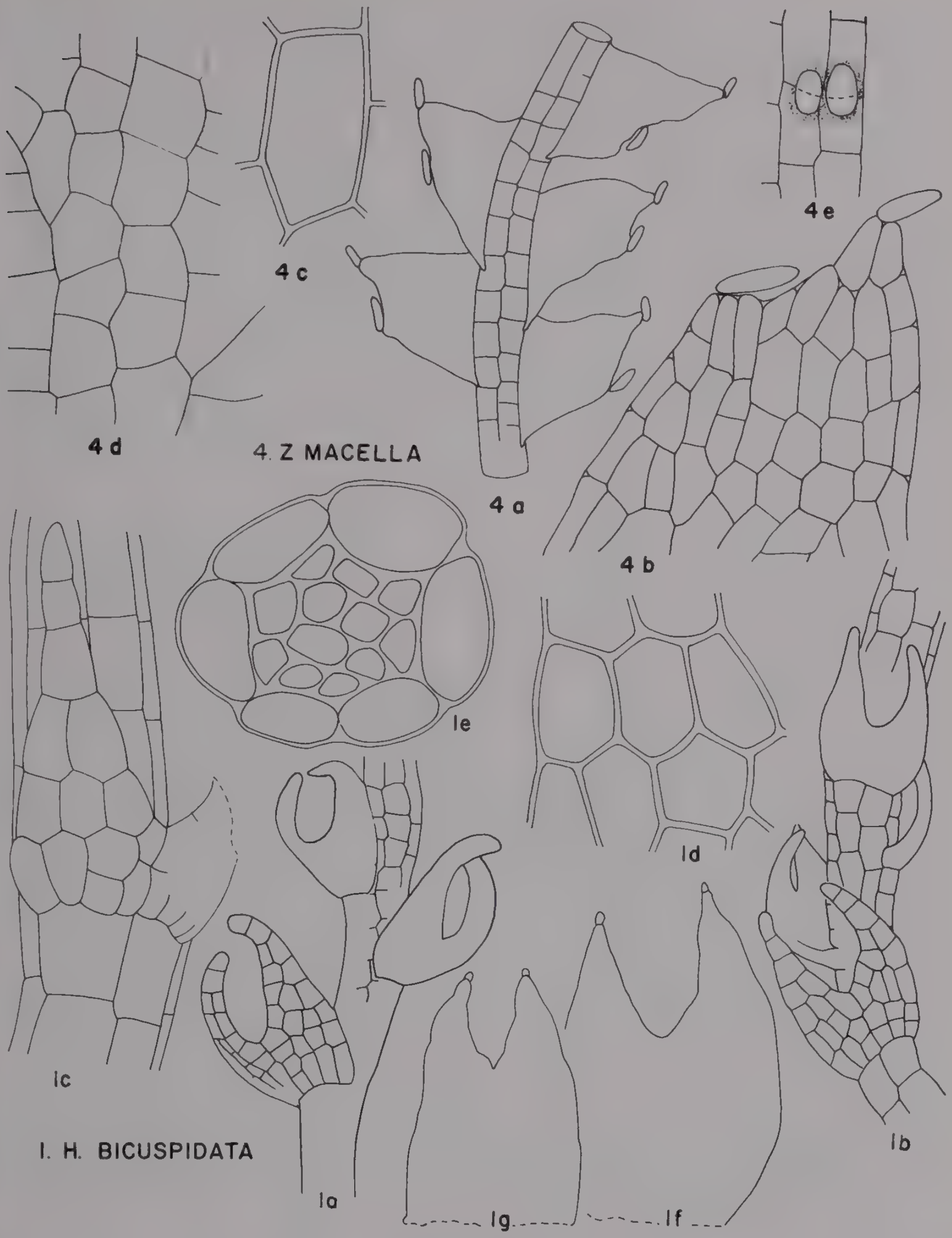

Plate 101

FIG. 4. *Zoopsis macella.* 4 a. Stem, dorsal view, × 70. 4 b. Leaf, × 200. 4 c. Leaf cell, × 500. 4 d. Dorsal cortical cells of the stem, × 200. 4 e. Underleaf on the stem, × 200. Drawn from the type.

FIG. 1. *Hyalolepidozia bicuspidata.* 1 a. Stem, dorsal view, × 50. 1 b. Stem, ventral view, × 50. 1 c. Stem and leaf, lateral view, × 360. 1 d. Leaf cells from the base of a segment, × 360. 1 e. Transverse section of a stem, × 360. 1 f. Female bract, inner series, × 85. 1 g. Female bracteole, inner series, × 85. Figs. 1 a, c, d, drawn from the type; figs. b, e–g from *Schwabe 198.*

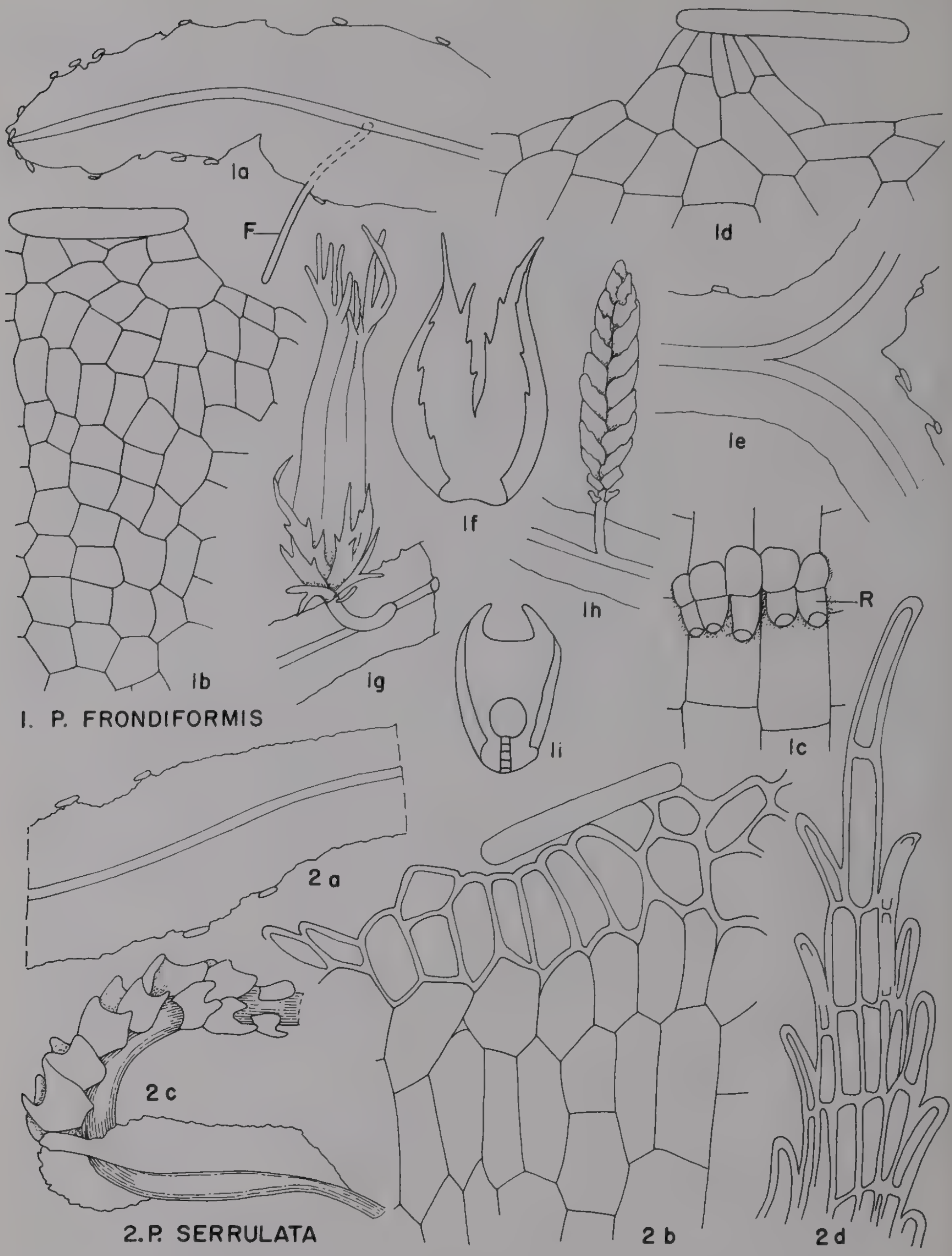

Plate 102

FIG. 1. *Pteropsiella frondiformis*. 1 a. Thallus, × 15; F, flagelliform branch. 1 b. Portion of a thallus wing with a marginal tooth bearing a long papilla, × 200. 1 c. Underleaf with rhizoids, × 200. 1 d. Thallus margin with a long tooth bearing the papilla, × 200. 1 e. Portion of a thallus with a *Frullania* type branch, × 20. 1 f. Female bract. 1 g. Female inflorescence and perianth on a ventral branch. 1 h. Ventral branch with male inflorescence. 1 i. Male bract and antheridium. Fig. 1 a–c, from an isotype (NY); 1 f–i, after *Spruce*, 1885; 1 d, e, from Venezuela, *Steyermark 60485*.

FIG. 2. *P. serrulata*. 2 a. Thallus, × 15. 2 b. Portion of a thallus wing with the serrate

attached = 2 + 2 lateral, and 4 on the convex ventral side) surrounding a medulla of smaller cells. Branches frequent, occasionally lateral of the *Frullania* type (the thallus "forking"), more frequently ventral-intercalary, axillary, thalloid, or flagelliform, or foliate-sexual. Rhizoids in tufts associated with the underleaves or in discrete tufts in three rows on the flagelliform branches. Wings formed from leaves fused edge to edge along the lateral margins, more rarely fused only part way, the succubous habit sometimes evident. Underleaves reduced to a few cells, 2, 4, 6 or 8 cells wide, 1–3 cells high. Plants monoicous or dioicous, the inflorescences foliaceous. Male inflorescence long spicate, terminal on a flagelliform tip of the thallus or as a ventral sexual branch; bracts bifid, monandrous, bracteoles few-celled. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 series, the innermost series largest, bifid. Perianth cylindrical below, 3-keeled above, the mouth 3-lobed, 6-laciniate. Shoot-sporophyte relationship a shoot-calyptra with unfertilized archegonia to near the apex. Capsule small, oblong in outline, the wall 2-layered; seta in transverse section, of 8 large outer cells surrounding 4 similar cells.

Type species: *Pteropsiella frondiformis* Spruce, 1876.

Key to the Species

Margins of the thallus conspicuously serrate; cells of the outer 1 or 2 rows smaller than those of the rest of the wing. 2. *P. serrulata.*
Margins of the thallus entire or with an occasional several-celled tooth; marginal cells scarcely different from those of the rest of the wing. 1. *P. frondiformis.*

1. Pteropsiella frondiformis Spruce, Jour. Bot. London **14**: 161. 1876.

Cephalozia subg. *Pteropsiella, frondiformis* Spruce, On *Cephalozia* 25. 1882.

Thallus prostrate, olive-green to dark green, 1–3 cm long, 3–5 mm wide, the axis flattened dorsally, of 2 cortical rows of large cells between the 2 broad unistratose wings, sometimes becoming flagelliform at the tip; branches occasionally lateral, of the *Frullania* type (the thallus "forked"), usually ventral-intercalary, in the axils of the minute underleaves, forming a winged thallus, or a flagelliform or a sexual branch. Rhizoids from the base of the few-celled underleaves. Wing margin straight or occasionally incised or with 1- to 3-celled irregular teeth, these then bearing the "slime" papillae; papillae elongate parallel to the margin, mostly 160 × 10–17 μ; cells of the wing quadrate to rectangular in outline, 34–75 × 30–40 μ, the marginal row not essentially different, the walls thin, without trigones, the cuticle faintly verruculose. Underleaves 2–4 cells across, one to a few cells high. Plants dioicous. Male inflorescence foliaceous, long, spike-like, leafy, ventral or terminal on the winged thallus, the bracts in 2 rows, in 8–12 series, bifid or retuse, the bracteoles few-celled. Female inflorescence foliaceous, on a short sexual branch, the bracts and bracteoles large, bifid, the segments incised. Perianth long, cylindrical below, with three rounded keels above, the mouth ciliate-laciniate.

Pl. 102. Fig. 1, a–i.

Habitat: On moist river banks, sandy flats and decaying bark and wood in shaded areas.

VENEZUELA: Bolívar: near Salto de Pacairao, 1220 m, *Steyermark 60485* (F).
BRAZIL: San Gabriel et San Carlos, *Spruce*, *Hep. Spruc.* (isotypes G, NY).

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margin of smaller cells and scattered long papillae, × 200. 2 c. Terminal male inflorescence, × 50. 2 d. Segment from the mouth of the perianth, × 200. Drawn from an isotype, *Spruce*, *Hep. Spruc.* (NY).

2. Pteropsiella serrulata Spruce ex Stephani, Spec. Hep. **3**: 276. 1908.

Pteropsiella serrulata Spruce, *Hep. Spruc.*, in Hb.
Pteropsiella metzgeriaeformis Schuster, Nova Hedwigia **10**: 25. 1965.

Thallus prostrate, olive-green to dark green, 1–3 cm long, 3–5 mm wide, sometimes becoming flagelliform at the tip, the axis flattened dorsally, of 2 rows of large cells between the unistratose wings, the long narrow slime papillae parallel to the closely serrate margin; branches ventral-intercalary in the axils of the few-celled underleaves (more rarely lateral, of the *Frullania*-type, "forking"), forming a winged thallus, a flagelliform branch or a short sexual branch. Rhizoids associated with the underleaves. Wing margin irregular, closely serrate, of smaller thick-walled cells, the elongate slime papillae numerous, parallel to the margin, to 117 μ long; cells of the wing mostly 85–136 μ long, 35 μ wide, thin-walled, without trigones, cells of the margin 32–39 × 26 μ, thick-walled, the cuticle verruculose. Underleaves of 1 or 2 rows of 2 or 4 cells. Plants monoicous. Male inflorescence long, spike-like, foliaceous, terminal on the thallus which had become flagelliform or on a ventral sexual branch; bracts in 8–12 series, bifid or retuse, monandrous, the bracteoles of only a few cells. Female inflorescence a short ventral branch, the bracts and bracteoles bifid, the segments laciniate. Perianth long, cylindrical below, 3-keeled above, the mouth of 6 ciliate segments. Sporophyte not seen.

Pl. 102. Fig. 2, a–d.

Habitat: Unknown.

VENEZUELA: Orinoco, *Lützelburg 22319/2* (S-PA).

BRAZIL: San Gabriel et S. Carlos, *Spruce, Hep. Spruc.* (G-13449), packets labeled *P. frondiformis* (NY); fl. Negro et Uaupés, *Spruce, Hep. Spruc.* (isotype NY); same locality, *Spruce, Hep. Spruc.*, as *P. metzgeriaeformis* (NY).

HYALOLEPIDOZIACEAE Fulford, fam. nov.

Caules erectiusculi, plus minusve radiales; rami terminales (typus *Frullaniae* et *Microlepidoziae*), vel laterales vel ventrali-intercalares, axillares; caulium cortex 6 seribus magnarum cellularum medullaque cellularum parviorum. Rhizoidea e basi amphigastriorum. Folia subtransverse inserta. Folia amphigastriaque similaria, bifida. Inflorescentia masculina terminalis vel intercalaris. Inflorescentia feminea in ramo brevi ventrali, bracteis bracteolisque bifidis. Perianthium cylindricum, 3-carinatum, carina tertia ventrali.

Leafy stems radially symmetric or nearly so, irregularly branched; branches terminal, of the *Frullania* and *Microlepidozia* types, or lateral- or ventral-intercalary, axillary, leafy or as flagelliform-stolons; stem in transverse section of 6 very large thin-walled cortical cells surrounding a medulla of small cells. Rhizoids from the bases of the underleaves. Leaf insertion transverse or subtransverse. Leaves and underleaves similar, bifid, the underleaves sometimes slightly smaller. Male inflorescence terminal becoming intercalary on the stem, the bracts and bracteoles similar, slightly smaller than the leaves and underleaves. Female inflorescence on the stem or a branch, the bracts and bracteoles bifid. Perianth cylindrical below, 3-keeled above, the third keel ventral.

Type genus: *Hyalolepidozia* S. Arnell ex Grolle, 1963.

Hyalolepidozia S. Arnell ex Grolle, Rev. Bryol. Lichénol. **32**: 179. 1963. [1964]

Lepidozia auct. p.p.
Paracromastigum Schuster, Jour. Hattori Bot. Lab. **26**: 275. 1963. Non Fulford & J. Taylor.

Stems flaccid, more or less radially symmetric, leafy or becoming more or less stolon-like flagelliform, irregularly branched; branches terminal, leafy, of the *Frullania* and *Microlepidozia* types, and lateral- and ventral-intercalary, axillary, leafy or flagelliform; stem in transverse section of a cortical layer of 6 very large cells surrounding the medulla of small cells. Rhizoids from the bases of the underleaves. Line of leaf insertion transverse or nearly so. Leaves bifid, the segments acute. Underleaves similar to the leaves, often slightly smaller. Plants monoicous and dioicous. Male inflorescence terminal becoming intercalary on the stem or branch, the bracts and bracteoles similar to the leaves and underleaves, smaller. Female inflorescence on the stem or a branch, the bracts and bracteoles bifid. Perianth cylindrical below, 3-keeled above.

Type species: *Lepidozia bicuspidata* Massalongo, 1885.

Hyalolepidozia bicuspidata (Massalongo) S. Arnell ex Grolle, Rev. Bryol. Lichénol. 32: 179. 1963. [1964]

Lepidozia bicuspidata Massalongo, Nuovo Giorn. Bot. Ital. **17**: 239. *pl. 22, f. 25.* 1885.
Hyalolepidozia bicuspidata (Massalongo) S. Arnell, Bot. Not. **115**: 213. 1962. non rite public.
Paracromastigum bicuspidatum (Massalongo) Schuster, Jour. Hattori Bot. Lab. **26**: 276. 1963.

Plants filiform, flaccid, more or less radially symmetric, whitish, green, among other bryophytes; stems to 2 cm long, leafy or becoming stolon-like flagelliform or small-leaved, irregularly branched; branches terminal, leafy, of the *Frullania* and *Microlepidozia* types, or ventral-intercalary, axillary, leafy or flagelliform. Stem in transverse section of 6 rows of very large hyaline cells surrounding a medulla of about 10 small cells. Rhizoids from the bases of the underleaves. Line of leaf insertion transverse or nearly so. Leaves distant, erect, bifid to one-half or more, the sinus lunulate, the segments lanceolate-acuminate; leaf-cells of the segments averaging 45 × 27 μ, the shorter cells averaging 40 × 36 μ, the walls thin, the cuticle smooth. Underleaves similar to the leaves, often slightly smaller. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem, the bracts concave, monandrous. Female inflorescence terminal on a stem or branch, the bracts and bracteoles in 3 series, bifid to one-third their length, the segments entire. Perianth cylindrical below, weakly 3-keeled above [the mouth ?-material too poor.]

Pl. 101. Fig. 1, a–g.

Habitat: In wet areas among other hepatics.

CHILE: Isla Poluqui, *Schwabe 198*, ex Hb Herzog (G-11101).

TIERRA DEL FUEGO: Río Azopardo, *Dusén 55* (NY); Staten Island: Port Cook, *Spegazzini 45 b* (type G); Mt. Richardson, *Spegazzini 159* (G-11100).

References

Arnell, S. 1963. Hepaticae of South Africa. Stockholm. 411 p.
Schuster, R. M. 1963. Studies on Antipodal Hepaticae. I. Jour. Hattori Bot. Lab. **26**: 185–309.

ALOBIELLACEAE Fulford, fam. nov.

Caules foliosi e caudice sine foliis, complanati, ramis ventrali-intercalaribus; cellulae dorsales corticales maiores quam ceterae plerumque longiores quam latae. Rhizoidea e parte ventrali caulis. Folia oblique inserta, succuba, breviter bifida. Amphigastria magna, bifida. Inflorescentia masculina terminalis vel intercalaris. Inflorescentia feminea in ramo brevi ad caulem foliosum. Perianthium 3-carinatum, carina tertia ventrali.

Leafy stems complanate from a leafless caudex or from flagelliform branches. Branching ventral-intercalary from the leafy stem or intercalary from the leafless axis. Stem flattened dorsally, convex below, the dorsal cortical rows of cells much larger than the rest. Rhizoids colorless, from the ventral side of the stem or all parts of the leafless axes. Leaves oblique, succubous, plane, very shortly bifid. Underleaves large, bifid to one-half. Male inflorescence terminal becoming intercalary on the leafy branch, both bracts and bracteoles present. Female inflorescence on a short leafy branch from the leafy stem, the bracts and bracteoles similar to the leaves and underleaves, more deeply bifid. Perianth 3-keeled above, the third keel ventral.

Type genus: *Alobiella* (Spruce) Schiffner, 1895.

Alobiella (Spruce) Schiffner in Engler & Prantl, Nat. Pflanzenf. **1**^{3}: 98. 1895 [Jan.]

Cephalozia Subg. IV *Alobiella* Spruce, On *Cephalozia* 28. 1882.

Leafy stems from a leafless caudex, complanate, light green, irregularly branched; branches ventral-intercalary, leafy, more rarely flagelliform, often caudex-like and bearing several leafy stems; stems flattened dorsally, with two rows of very large cells between the rows of leaves, the ventral side convex, with many small cortical cells; in transverse section the cortical layer of 4 or 5 very large cells (dorsal) and many small cells (ventral) surrounding a medulla of many small cells. Rhizoids long, slender, colorless, scattered along the ventral side of the stem. Line of leaf insertion nearly longitudinal, the leaves succubous. Leaves plane, widely spreading, ovate, the tip bidentate, bidenticulate or rarely acute, the margin plane with or without a border of narrow, elongate cells; leaf cells mostly rectangular, the walls uniformly thickened, without trigones, the cuticle essentially smooth. Underleaves large, rectangular in outline, bifid to one-half their length, the segments narrowly triangular, equal or one shorter than the other, parallel or spreading. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem or a leafy branch, the bracts leaf-like, pouched near the transverse insertion, bracteoles like the underleaves. Female inflorescence on a short ventral-intercalary leafy branch, the bracts and bracteoles in several series, bifid. Perianth long, cylindrical below, 3-keeled above, the mouth lobed, setulose. Shoot-sporophyte relationship a shoot-calyptra. Capsule wall of 2 layers of cells with characteristic markings. Regeneration from filaments grown out from leaf-cells.

Type species: *Jungermannia husnoti* Gottsche, 1874.

Key to the Species

Leaves bidentate, bidenticulate or acute, bordered by one or more rows of long, narrow cells; underleaf segments of equal length. 1. *A. husnoti.*
Leaves bidenticulate or acute, not bordered; one segment of the underleaf shorter than the other. 2. *A. campanensis.*

1. Alobiella campanensis Stephani, Spec. Hep. **6**: 443. 1924; Icon. Hep. *Alobiella no. 4.*

Leafy stems from a caudex, complanate, small, whitish-green becoming light brown, ascendant in tufts. Stems 1–2 cm long, with leaves 1.5–2 mm wide, occasionally branched, the branches ventral-intercalary in the axils of underleaves, leafy or more rarely flagelliform and bearing leafy branches; stems flattened dorsally, with 2 rows of very large cortical cells between the rows of leaves, on the ventral side convex and of many smaller cortical cells. Rhizoids long, slender, scattered on the ventral side of the stem. Line of leaf insertion nearly longitudinal. Leaves subimbricate, plane, widely spreading, ovate, acute to bidenticulate, 0.7–0.9 mm long, 0.3–0.4 mm wide at the middle, the base straight, the margins entire, not bordered by narrow cells; cells of the upper part of the leaf rectangular, 50–65 × 20–25 μ, the walls slightly thickened, without trigones, the cuticle essentially smooth. Underleaves appressed, longer than broad, bifid to one-half, the segments long, narrow-triangular, unequal. Male and female inflorescence and perianth not seen. Regeneration from leaf cells.[10]

Pl. 103. Fig. 1, a–h.

Habitat: Unknown.

PERU: Monte Campana, *Spruce* (type G-606); Monte Guayrapurina, *Spruce*, *Hep. Spruc.*, as *A. husnoti* (BM, MANCH, NY).

2. Alobiella husnoti (Gottsche) Schiffner in Engler & Prantl, Nat. Pflanzenf. **1**^{3}: 98. 1895.

Jungermannia husnoti Gottsche in Husnot, *Hep. Antill. Exsicc.* no. 242. 1874.
Cephalozia Subg. IV *Alobiella, husnoti* (Gottsche) Spruce, On *Cephalozia* 30. 1882.
Jungermannia lancifolia Spruce ms. 1885.

Leafy stems arising from a leafless caudex, complanate, of small to medium size, whitish-green becoming brownish, in dense mats or among other bryophytes. Stems 1.0–3 cm or more long, with leaves to 3 mm broad, prostrate to ascending, occasionally branched; branches ventral-intercalary in the axils of the underleaves, leafy or flagelliform, the latter (as a caudex) often bearing many leafy branches; stems flattened dorsally, cells of the 2 dorsal cortical rows between the leaves very large, 70 × 60 μ, the cells under the leaf insertion also large, the ventral side of the stem convex, the cortical cells numerous, narrow; in transverse section the layer of cortical cells in about 12–16 rows, the 5 or 6 cells from the dorsal merophytes very large, those from the ventral merophyte small, the medulla of many cells scarcely larger than the ventral cortical cells. Rhizoids long, slender, from the ventral cortical cells of the stem. Line of leaf insertion nearly longitudinal, the leaves succubous. Leaves plane, widely spreading, ovate to 1.3 mm long, often shorter, to 0.6 mm broad at the middle, the apex shortly bidentate, bidenticulate or more rarely acute, the margins entire or rarely crenulate from projecting cell ends, the marginal cells long, narrow, forming an inconspicuous border; cells of the upper part of the leaf rectangular, 52–70 μ or longer, 26–35 μ wide, the walls uniformly thickened, without trigones, the cuticle essentially smooth. Underleaves appressed to the stem, long, rectangular in outline, bifid to one-half, the segments narrow-triangular, parallel or spreading above, the cells as in the leaf. Plants dioicous. Male inflorescence

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[10] On a stem of the type material, many of the leaf-cells, particularly those of the lower part of the leaf, had become enlarged and bulged at one end. Growth and cell division had continued in some to form long branched filaments.

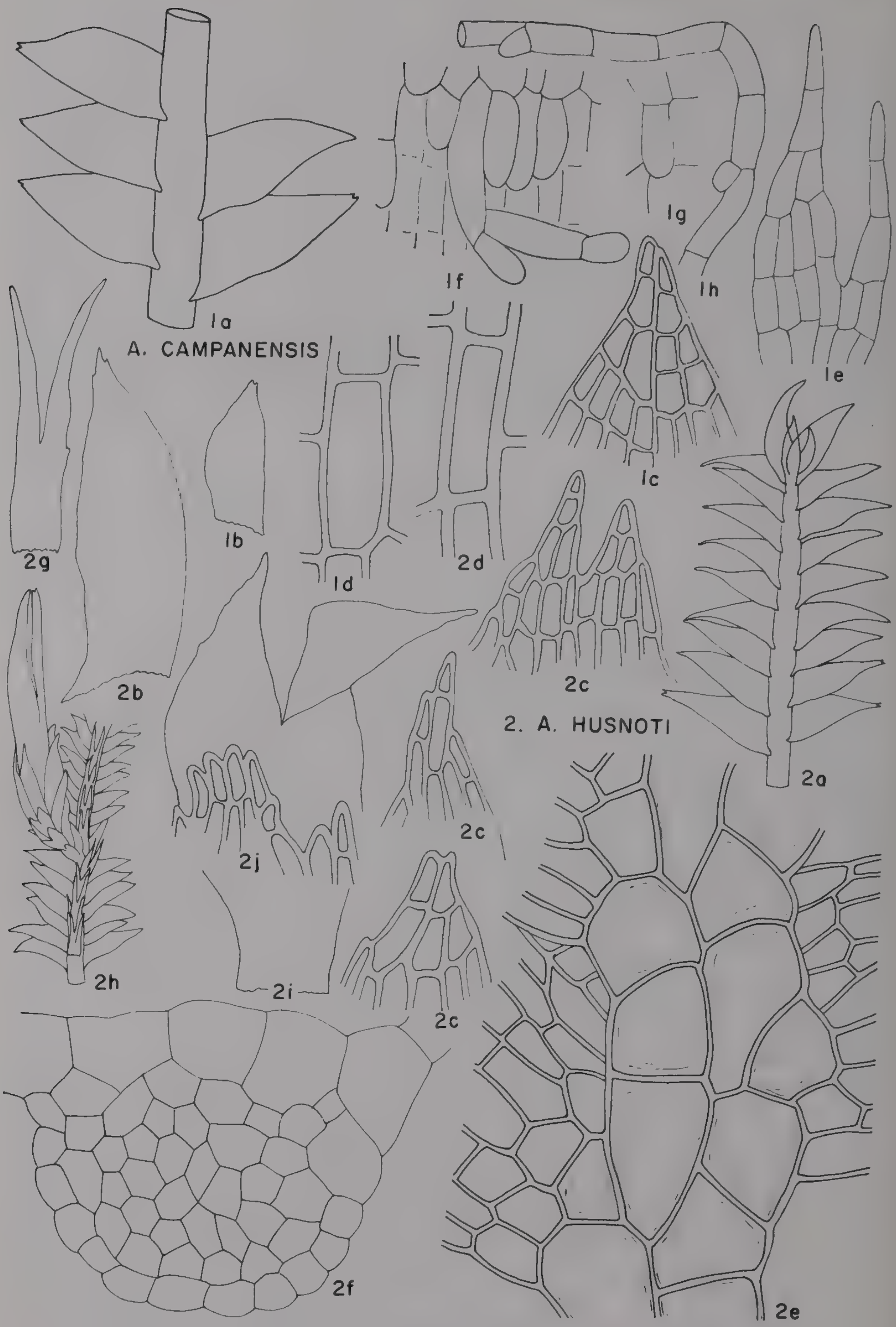
1a
A. CAMPANENSIS
1b
1c
1d
1e
1f
1g
1h
2. A. HUSNOTI
2a
2b
2c
2c
2c
2d
2e
2f
2g
2h
2i
2j

Plate 103

terminal on the leafy stem or branch, the bracts and bracteoles in to 10 or more series, the bracts similar to the leaves but with the dorsal third transversely attached and curved forming a dorsal pouch, the upper part spreading; bracteoles like the underleaves. Female inflorescence on a short leafy ventral branch, the bracts and bracteoles in 3 or 4 series, the innermost series largest, the bracts bifid to one-half their length, the segments triangular, the margins crenulate from projecting cell ends, the bracteoles similar, somewhat smaller. Perianth long, cylindrical below, 3-keeled above, the mouth lobed, setulose.

Pl. 103. Fig. 2, a–j.

Habitat: In light green mats or tufts on moist shaded soil banks and rocks, often with other bryophytes.

PUERTO RICO: Luquillo Mountains: El Yunque Trail, *Evans 56* (NY, Y); Catalina-Yunque Trail, *E. G. Britton 7727, 7728* (NY); El Yunque, 1800 ft, *Pagán 1039* (NY); near summit of Mt. Britton, *Fulford, Crandall & Stotler 619, 622* p.p., *652* p.p. (Hb Fulford); summit, Sierra Naguabo, El Duque, *Schafer 3721* (NY); trail to Torito Mountain 3050 ft, *Pagán* (NY).

ST. KITTS: near summit, Mt. Misery, *N. L. Britton & Cowell 786* (NY).

GUADELOUPE: Rivière Rouge, 700 m, *Husnot, Pl. Antilles, No. 242* (lectotypes MANCH, NY); Rivière Rouge, 700–800 m, *Duss 372* (NY); 600–1400 m, *Duss 132-255-256* (NY); Morne Goyave, *Duss 65c* (NY); Morne Gobelm, *Duss 235* (NY); Soufrière, *Le Gallo 242* p.p. (Hb Le Gallo).

MARTINIQUE: Mt. Pelée, *Duss 327-585* (NY); Morne Paillasse, 700–900 m, *Duss 92-221* (NY).

DOMINICA: Morne Micotrin, *Elliott 1139d* (BM); Morne Anglais, *Elliott 487f* p.p. (BM), 494 (MANCH); Morne Trois Pitons, *Elliott 718* (MANCH), 2279 p.p. (BM).

TRINIDAD: s.l., *Fendler* [b] (NY).

CLADOMASTIGACEAE Fulford in Steyermark, Acta Bot. Venezuelica **2**: 79. 1967.

Leafy stems prostrate, sometimes becoming small-leaved radial above, light green, irregularly branched, the branches ventral-intercalary, in the axils of the underleaves, leafy or flagelliform, or short, male or female; stem in transverse section with the cells mostly large, the cortical layer with thick walls. Rhizoids from the ventral side of the stem, scarce. Line of leaf insertion oblique. Leaves succubous, bifid, the cell-walls uniformly thickened with a whitish ring of thickening. Underleaves nearly half as long as the leaves, bifid. Male inflorescence catkin-like, the bracts and bracteoles bifid; antheridia in the axils of the bracts. Female inflorescence on a short sexual branch, the bracts and bracteoles in 3 or 4 series, bifid, the innermost series largest, with a supplementary tooth on each side above. Perianth long, 3-keeled, the third keel ventral, of 1 layer of cells, the mouth contracted, ciliate-laciniate. Sporophyte not seen.

Type genus: *Cladomastigum* Fulford, 1967.

Plate 103

FIG. 1. *Alobiella campanensis*. 1 a. Stem, dorsal view, × 50. 1 b. Leaf, × 40. 1 c. Leaf apex, × 180. 1 d. Cell from the upper part of a leaf, × 500. 1 e. Underleaf, × 180. 1 f. Regeneration of cells from near the base of a leaf, × 200. 1 g. A cell from this area, enlarged at one end, × 200. 1 h. Portion of a filament from one of the leaf cells, × 200. Drawn from the type.

FIG. 2. *A. husnoti*. 2 a. Stem, dorsal view, × 20. 2 b. Leaf, × 40. 2 c. Leaf apices, × 180. 2 d. Cell of the upper part of a leaf, × 500. 2 e. Dorsal surface of a stem with leaves attached, × 360. 2 f. Transverse section of the stem, × 360. 2 g. Underleaf, × 40. 2 h. Stem with female inflorescence and perianth, × 16. 2 i. Female bract, inner series, × 40. 2 j. Portion of the perianth mouth, × 200. Fig. 2 a–i, drawn from a portion of the type; 2 j, from plants from Puerto Rico, *Pagán*.

Cladomastigum Fulford in Steyermark, Acta Bot. Venezuelica **2**: 80. 1967.

The characters of the genus are those of the species.

Type species: *Cladomastigum bifidum* Fulford.

1. **Cladomastigum bifidum** Fulford in Steyermark, Acta Bot. Venezuelica **2**: 80. *f. 1, 2.* 1967.

Plants small, light green to whitish-green, prostrate, in dense mats or among other bryophytes. Stems to 2 cm long, with leaves to 0.6 mm wide, sometimes becoming small-leaved radial toward the tip, irregularly branched; branches frequent, ventral-intercalary, in the axils of the underleaves, long, leafy or flagelliform, or short male and female; stem in transverse section 7–12 cells across, the cells mostly large, the cortical layer with thicker walls than the cells of the medulla. Rhizoids from the ventral side of the stem. Line of leaf insertion oblique. Leaves subimbricate, rectangular to ovate-truncate in outline, widely spreading, plane, 0.33–0.38 mm long, bifid to one-third their length, the segments often unequal, triangular from a 3- to 5-celled base, ending in a uniseriate tip three to five cells long, the margin crenulate; leaf cells at the base of a segment 18–27 × 27 μ, the marginal row often smaller, the walls uniformly thickened, the thickening as a whitish ring within the cells, the trigones not distinct, the cuticle coarsely verruculose and with scattered larger papillae. Underleaves rather large, not as wide as the stem, oblong-ovate, bifid to three-fourths their length, the lamina with a small projection on each side. Plants dioicous. Male inflorescence short, catkin-like, the bracts and bracteoles in 3–6 series, the bracts concave, with a fold bent up on the dorsal side, the bracteoles smaller than the underleaves; antheridia large, in the axils of bracts. Female inflorescence on a short ventral branch, the bracts and bracteoles in 3 or 4 series, bifid, the innermost series largest, the bracts of this series with a lateral tooth on the upper margins. Perianth 1.5 mm long, cylindrical below, 3-keeled above, of 1 layer of cells, the mouth contracted, the 3 lobes ciliate and laciniate. Sporophyte not seen.

Pl. 104. Fig. 1, a–j.

Habitat: In mats on sandy banks, cliff faces or among other bryophytes on trees.

VENEZUELA: Amazonas: Cerro Huachamacari, Río Cunucunuma, Caño de Dios, 1900 m, *Maguire, Cowan & Wurdack 30276* p.p., *30277* (NY). Bolívar: Auyan-tepuí, Río Churún, s e sureste der 'Second Wall,' 1690 m, *Steyermark 93296*, *93299*, *93300* (type), alt. 2150–2200 m, *Steyermark 94056*, *94058* (VEN). Chimantá Massif, Abácapá-tepuí, 1300 m, *Steyermark 75217* p.p. (NY); Torono-tepuí, 1910–1970 m, *Steyermark & Wurdack 975* p.p. (NY).

PHYCOLEPIDOZIACEAE Schuster, Bull. Torrey Club **93**: 442. 1966.[11]

Gametophyte a caudex- or stolon-like terete green axis, sparingly branched, the branches intercalary, stolon-like or short male and female. Rhizoids from the ventral side of the axis. Leaves and underleaves absent. Male inflorescence bud-like, foliaceous, terminal becoming intercalary on the axis; bracteoles absent. Female bracts foliaceous in 2 or 3 series, small, bifid. Perianth trigonous above, the mouth 6-lobed. Seta in transverse section of 4 rows of large external cells surrounding 4 rows of tiny internal cells. Capsule wall very thin, 2-layered; spores small; elaters attenuate, bispiral.

Type genus: *Phycolepidozia* Schuster, 1966.

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[11] These descriptions are compiled from Schuster, 1966.

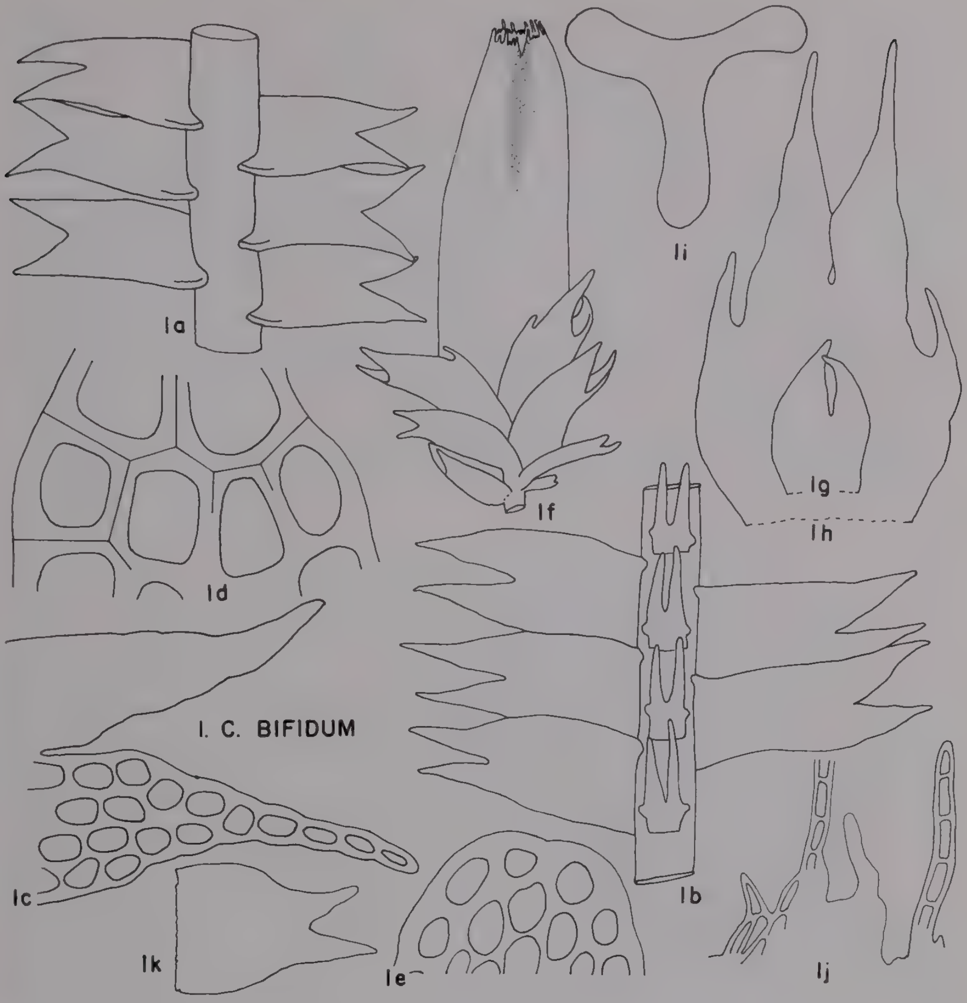

Plate 104

Fig. 1. *Cladomastigum bifidum*. 1 a. Stem, dorsal view, × 75. 1 b. Stem, ventral view, × 75. 1 c. Upper part of a leaf, × 300. 1 d. Leaf cells from the base of a segment, × 700. 1 e. Portion of a transverse section of a stem, × 300. 1 f. Female inflorescence and perianth, dorsal view, × 50. 1 g. Female bract, outer series, × 75. 1 h. Female bract of the inner series, × 75. 1 i. Outline of a transverse section of a perianth. 1 j. Portion of the mouth of the perianth, × 150. 1 k. Male bract, × 75. Drawn from the type.

Phycolepidozia Schuster, Bull. Torrey Club **93**: 438. 1966.

Since the genus is monotypic, the characters of the genus are those of the species.

Type species: *P. exigua* Schuster, 1966.

Phycolepidozia exigua Schuster, Bull. Torrey Club **93**: 440. *f. 1, 2.* 1966.

Plants tiny, consisting of a branched green caudex- or stolon-like axis with foliaceous male and female inflorescences. Caudex opaque, subterete to elliptical, irregularly branched, the branches intercalary; in transverse section the axis of 5 rows of cortical cells (2 + 2 lateral, 1 ventral) and 1 medullary cell. Rhizoids in a row on the ventral side of the axis. Slime papillae (scales) in two dorsolateral rows. Plants autoicous. Male inflorescence foliaceous on a short branch or terminal "even becoming intercalary" on a leading axis, the leafy bracts tiny, in 3–6 pairs, bifid, monandrous, the bracteoles lacking; antheridial stalk of 1 row of cells or 1-celled. Female inflorescence foliaceous on a very short branch, the bracts in 2 or 3 series, the inner series the largest, bifid, the segments acuminate, the margins dentate from projecting cells. Perianth exserted, cylindrical below, 3-keeled above, the mouth of 6 dentate lacineae similar to the segments of the bracts. Capsule brownish, opening to the base by 4 valves, the wall of 2 layers of cells with brown thickening bands on the radial walls. Seta non-articulate, of 4 rows of very large cells surrounding 4 rows of tiny inner cells. Spores yellow-brown, granulate-vermiculate, 13–15 μ. Elaters 135–150 μ long, 72–78 μ in maximum diam, tapering, bispiral.

Pl. 106. Fig. 1, a–d.

Habitat: On bark in humid rain forest.

DOMINICA: between Crete Palmiste and Bois Diable Ridge, 1400 ft, coll. Schuster.

PARACROMASTIGACEAE Fulford, fam. nov.

Caules foliosi plus minus radiales vel dorsali-ventrales, cum vel sine caudice, ramis terminalibus (typus *Frullaniae* et *Acromastigi*) vel ventrali-intercalaribus foliosis vel flagelliformibus; caulium cellulis ventralibus corticalibus parvioribus quam cellulis dorsalibus. Rhizoidea e basi amphigastriorum. Folia transversa vel obliqua succubaque, bifida (aliquando trifida). Amphigastria similaria saepe parvioria. Inflorescentia masculina terminalis vel intercalaris, bracteis bracteolisque foliiformibus, saccatis. Inflorescentia feminea in ramo brevi e caudice, e flagellis vel raro e caule, bracteis bracteolisque bifidis cum vel sine dentibus marginalibus. Perianthium 3-carinatum insuper, carina tertia ventrali, ore 3-lobato setuloso-ciliato.

Plants small, with or without a prostrate caudex; branches terminal, of the *Frullania* and *Acromastigum* types, and ventral-intercalary, leafy or flagelliform; stem in transverse section with the ventral cortical rows of cells smaller than the dorsal rows. Rhizoids in tufts from the bases of the underleaves or in three rows of tufts from the flagelliform branches or the caudex. Line of leaf insertion transverse to oblique with the leaves succubous. Leaves bifid (occasional leaves trifid) to the middle or less. Underleaves similar, or to half as long as the leaves or less, bifid (some trifid). Male inflorescence terminal becoming intercalary on the stem, the bracts and bracteoles similar to the leaves and underleaves, slightly smaller, imbricate, the bracts monandrous. Female inflorescence on a short leafy branch, from the caudex, or a flagelliform branch, or occasionally from the leafy stem; bracts and bracteoles bifid, with or without marginal teeth or cilia. Perianth cylindrical below, 3-keeled above, the third keel ventral, the mouth 3-lobed, variously laciniate-ciliate.

Type genus: *Paracromastigum* Fulford & J. Taylor, 1961.

Key to the Genera

Ventral branches of the *Acromastigum* type abundant; ventral-intercalary branches also present. *Paracromastigum.*

Ventral branches all axillary, intercalary in origin; leafy axes usually arising from a leafless caudex. *Leucosarmentum.*

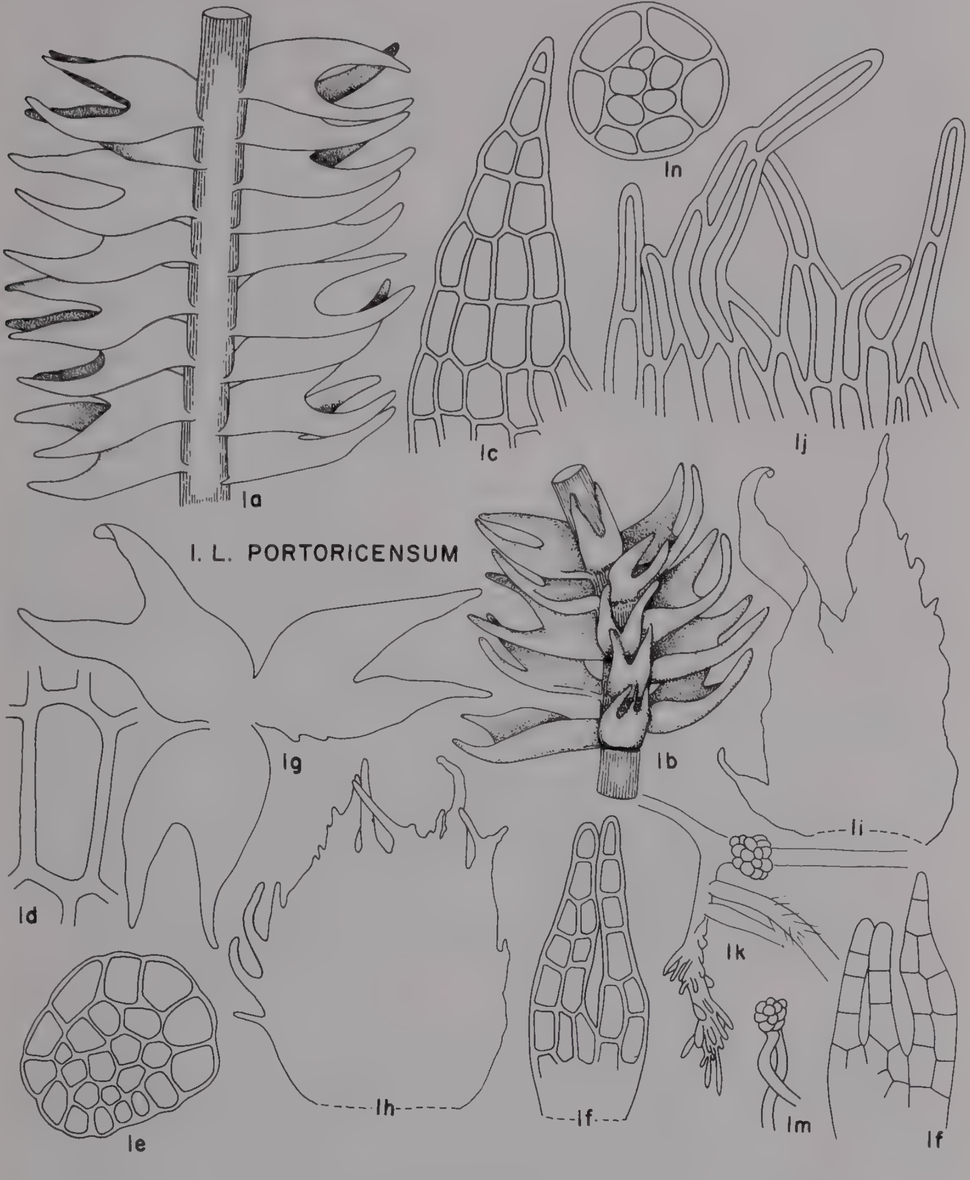

Plate 105

FIG. 1. *Leucosarmentum portoricensum*. 1 a. Stem, dorsal view, × 50. 1 b. Stem, ventral view, × 50. 1 c. Leaf segment, × 200. 1 d. Cell of a leaf segment, × 500. 1 e. Transverse section of the stem, × 200. 1 f. Underleaves. 1 g. Female bracts and bracteoles, outer series, × 50. 1 h. Bract, innermost series, × 50. 1 i. Bracteole, inner series, × 50. 1 j. Portion of the mouth of the perianth, × 200. 1 k. Caudex with leafy and flagelliform branches, and a cell mass, × 50. 1 m. Free cell pile with two rhizoids, × 50. 1 n. Transverse section of a young stem. Fig. 1 a–f, h, i, j, n from the type; fig. 1 g, k, m from *Sharp 2973*.

Leucosarmentum Fulford, gen. nov.

Alobiella auct. p.p.

Caules foliosi, e caudice irregulariter ramoso, prostrato. Caulium cortex 6–15 seriebus, cellulis dorsalibus maioribus. Rhizoidea e basi amphigastriorum. Folia oblique inserta, succuba, bifida. Amphigastria bifida, raro trifida. Inflorescentia masculina terminalis vel intercalaris. Inflorescentia feminea in ramo brevi caudicis, bracteis bracteolisque bifidis. Perianthium 3-carinatum insuper, ore 3-lobato, setulo-ciliato.

Plants small, consisting of a prostrate caudex and more or less ascending, somewhat complanate, leafy stems and flagelliform branches; branches of the caudex and the flagelliform branches axillary-intercalary, branches of the leafy axis infrequent, ventral-intercalary in the axils of the underleaves; stem in transverse section of a cortical layer of 6–15 cells, with the ventral rows smaller than the rest, surrounding 6–12 cells of the medulla. Rhizoids in tufts from the bases of the underleaves, or in 3 rows of tufts on the caudex and the flagelliform branches. Line of leaf insertion oblique, the leaves succubous. Leaves ovate-lanceolate, bifid to the middle, the segments lanceolate, the cells mostly longer than broad, the walls uniformly thickened. Underleaves conspicuous, bifid or occasionally trifid to the middle, the segments slender. Male inflorescence terminal becoming intercalary on the stem, the bracts and bracteoles similar to the leaves and underleaves, densely imbricate. Female inflorescence on a very short branch from the caudex or a flagelliform branch, the bracts and bracteoles in 3 or 4 series. Perianth 3-keeled above, the mouth 3-lobed, the lobes variously laciniate and ciliate. Vegetative reproduction from globose masses of cells formed on the caudex or the flagelliform branches.

Type species: *Alobiella bifida* Stephani, 1908.

Key to the Species

Leaves when well developed, plane, widely spreading, leaf segments from a 4- to 6-celled base; margins of the female bracts and bracteoles of the inner series variously toothed and ciliate. 1. *L. portoricense.*

Leaves when well developed often concave, sometimes spreading; leaf segments usually narrow, the base rarely more than 3 or 4 cells wide; margins of the female bracts and bracteoles of the inner series entire except for a lateral tooth on each side. 2. *L. bifidum.*

1. **Leucosarmentum portoricense** Fulford, sp. nov.

Folia plerumque plana, late patentia, segmenti basi 4–5 cellulis latitudine; cellulae 39–45 × 26 μ, margine bractearum bracteolarumque dentibus ciliisque.

Plants of small to medium size, whitish green, in loose mats or among other bryophytes; leafy stems 0.5–1.5 cm long, from a stolon-like leafless caudex or from stolon-like flagelliform branches 2–4 cm or more long, rarely branched; branches of the caudex and the flagelliform branches axillary-intercalary, leafy or flagelliform, the occasional branches of the leafy stem ventral-intercalary in the axils of the underleaves, leafy or flagelliform; leafy stem in transverse section with the dorsal cortical cells larger than the ventral, and larger than the cells of the medulla. Rhizoids abundant, on the underleaves or in tufts in three rows on the caudex and flagelliform branches. Leaf insertion oblique, the leaves succubous. Leaves approximate to imbricate, plane to somewhat concave, ovate, bifid to one-half the length, the segments long, slender, the cells mostly longer than broad; cells of the base of the segment 39–45 × 26 μ, the walls uniformly thickened, without trigones, the cuticle verruculose. Underleaves one-third to one-half as long as the leaves, bifid (some trifid) to the middle, the segments narrow. Plants dioicous. Male inflorescence terminal becoming intercalary on the leafy stem, the bracts and bracteoles densely imbricate in 5–10 series, similar to the leaves and underleaves. Female inflorescence tufted, on a very short branch, from the caudex or a flagelliform branch, usually hidden by the leafy stems, the bracts and bracteoles in 3 or 4 series, the outer series bifid with the margins entire or nearly so, the innermost series bifid, ciliate-laciniate, and the margins variously toothed and ciliate. Perianth longer than the bracts, cylindrical below, with 3 broad keels above, the lobes of the mouth variously ciliate and laciniate, the cilia mostly of 2 long cells. Capsule dark brown, the wall of 2 layers of cells with characteristic markings. Seta in transverse section of an outer layer of to 9 or more large cells surrounding a core of somewhat smaller cells. Vegetative reproduction from ovoid masses of cells on the caudex or flagelliform branches which become detached and give rise to new axes.

Pl. 105. Fig. 1, a–n.

Habitat: Moist shaded soil banks.

PUERTO RICO: El Yunque: La Mina USDA Station, 1020 m, *Fulford, Crandall & Stotler 164* (♀, ♂) (type Hb Fulford).
GUATEMALA: Alta Verapaz: n of Cobán, 4400 ft, *Sharp 2972* p.p., *2973* (TENN).

2. **Leucosarmentum bifidum** (Stephani) Fulford, comb. nov.

Alobiella bifida Stephani in Urban, Symb. Antill. **2**: 470. 1901.

Plants small, whitish-green, in compact low mats or among other bryophytes; leafy stems 0.5–1 cm or more long, from a leafless, stolon-like caudex or flagelliform branches; caudex and flagelliform axes hyaline, 2–3 cm or more long, abundantly branched, the branches axillary-intercalary, leafy, or very short female, or flagelliform and becoming leafy or stolon-like; leafy stems occasionally branched, the branches ventral-intercalary, axillary, and leafy or flagelliform; leafy stem in transverse section 5 or 6 cells across, the cortical layer of 8–10 cells, the cells of the ventral side smaller than the rest, the medulla of 6–10 smaller cells. Rhizoids from the bases of the underleaves or in 3 rows of discrete tufts on the stolon-like axes or flagelliform branches. Line of leaf insertion oblique. Leaves distant to subimbricate, mostly somewhat concave, spreading, to ascendant, narrowly ovate to subrectangular in outline, bifid to one-half the length, the sinus narrow, the segments lanceolate, ending in a tip 1 or 2 cells long; leaf cells rectangular, those of the base of the segments mostly 39–45 × 15–18 μ, the walls uniformly thickened, without trigones, the cuticle verruculose. Underleaves bifid or occasionally trifid to one-half the length, to half as long as the leaves or more robust stems, the cells as in the leaves. Plants dioicous. Male inflorescence terminal becoming intercalary on the leafy stem, the bracts and bracteoles densely imbricate, in few to many series, similar to the leaves and underleaves, slightly smaller, the bracts bifid, concave below. Female inflorescence on a very short branch from the caudex, occasionally with 1 or 2 flagelliform or leafy subfloral innovations, the bracts and bracteoles similar, in up to 4 series, the outer series bifid, the margins entire, the inner series bifid and with a short tooth on the lateral margin above the middle. Perianth cylindrical below, with 3 rounded keels above, the 3-lobed mouth laciniate. Vegetative reproduction from ovoid masses of 6–15 cells produced on the surface of the caudex or flagelliform axes.

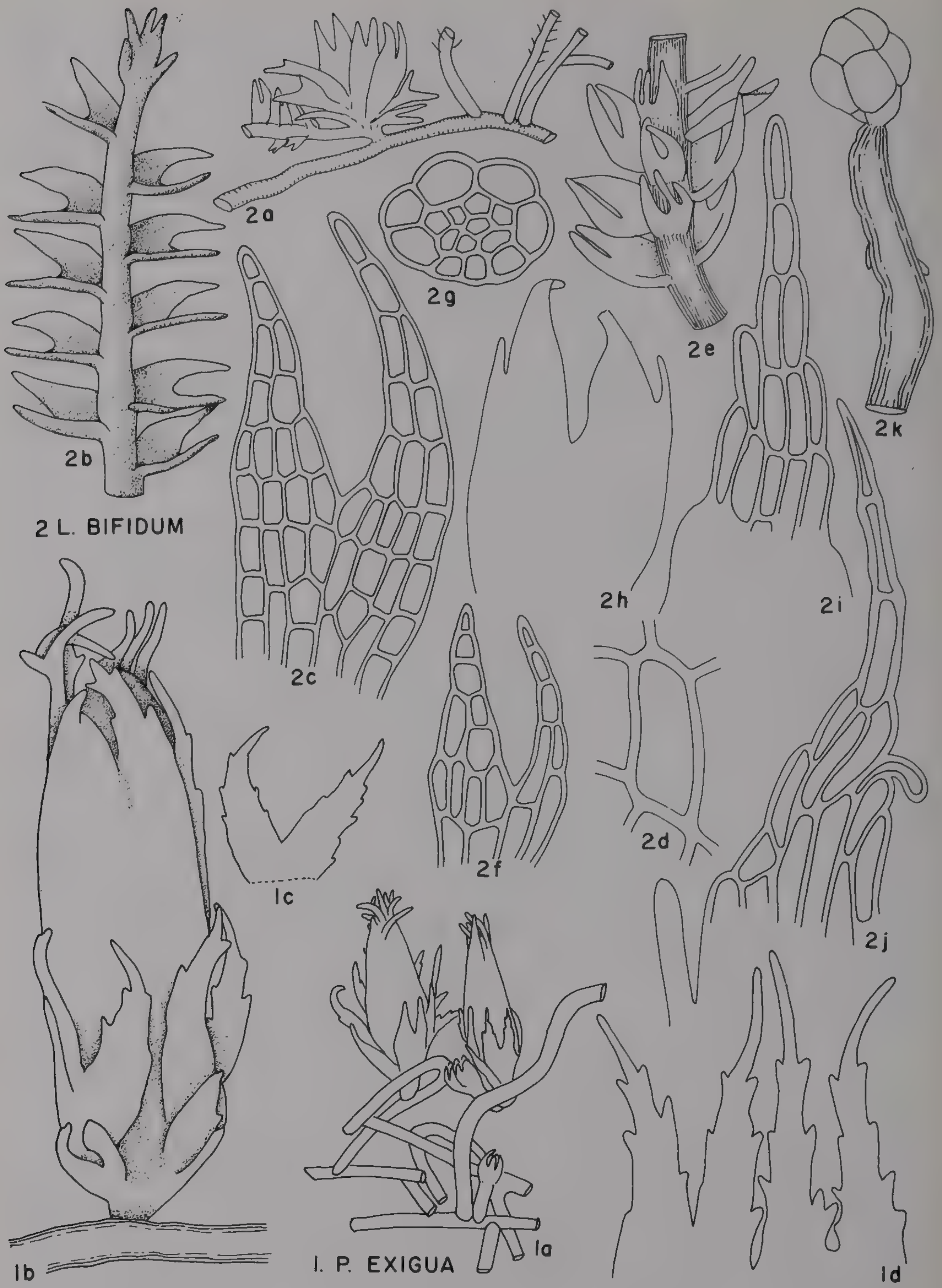
2a
2b
2 L. BIFIDUM
2g
2e
2k
2c
2h
2i
2d
2f
1c
2j
1b
I. P. EXIGUA
1a
1d

Plate 106

FIG. 1. *Phycolepidozia exigua.* 1 a. Plants, leafless stolons and leafy male and female inflorescences, × 48. 1 b. Female inflorescence and a perianth from a stolon, × 143. 1 c. Female bract, × 100. 1 d. Portion of the mouth of a perianth, × 195. After *Schuster*, 1966, with permission of the Torrey Botanical Club.

FIG. 2. *Leucosarmentum bifidum.* 2 a. Diagram of the caudex bearing a female branch and several leafy branches. 2 b. Stem, dorsal view, × 35. 2 c. Leaf, × 180. 2 d. Cell from the

Pl. 106. Fig. 2, a–k.

Habitat: Moist shaded soil banks among other bryophytes.

GUADELOUPE: Rivière Rouge, 400–900 m, *Duss 49–242* p.p. (NY); bois de Sofaga, 460 m, *Duss 49* (G-618); saut de Bouillante, 710 m, *Duss, 242* (type G-616); plateau de la Soufrière, 600–1400 m, *Duss 256* (♂) p.p. (NY); s.l., 830 m, *Duss 259* (G-615).

MARTINIQUE: Morne Paillasse, 700–900 m, *Duss 92a-221* p.p. (NY). Morne de la Calebasse, 670 m, *Duss 215* (G-617).

Paracromastigum Fulford & J. Taylor, Brittonia **13**: 336. 1961, emend.[12]

see Manual, Part II, *p. 177*

Plants small, pale green to yellowish-green, sometimes reddish-brown at the tips; stems slender, erect and tending to be radial, or dorsiventral, irregularly branched; lateral branches leafy, of the *Frullania* type, ventral branches of the *Acromastigum* type or axillary-intercalary, leafy or flagelliform; stem in transverse section of 9–12 cells, the ventral cortical cells smaller than the rest, the cells of the medulla smaller than the dorsal cortical rows. Line of leaf insertion transverse, or oblique with the leaves succubous. Leaves ovate, subquadrate, or rectangular in outline, bifid (occasional leaves trifid), to one-half the length. Underleaves bifid (with some trifid). Male inflorescence terminal becoming intercalary on the leafy stem, the bracts and bracteoles in few to many series, similar to the leaves and underleaves. Female inflorescence terminal on a short leafy branch. Perianth cylindrical below, with three broad, rounded keels above, the 3-lobed mouth laciniate and ciliate.

Type species: *Lepidozia subsimplex* Stephani, 1911.

Key to the Species

1. Stems tiny, more or less radial; leaves and underleaves approximately equal, transversely inserted. 1. *P. subsimplex.* p. 177
1. Stems larger, leaves at least twice as long as the underleaves.
   2. Plants whitish-green, rarely tinged with red toward the tip; leaves widely spreading, tending to be plane. 2. *P. pachyr*[*r*]*hizum.*
   2. Plants yellow-green to brownish, tinged with red near the tip; leaves patent or erect-spreading, more or less concave. 3. *P. stipulatum.*

1. **Paracromastigum subsimplex** (Stephani) Fulford & J. Taylor. See p. 177. *pl. 39.* 1966.

add synonym:

Pseudocephalozia obscura Schuster, Nova Hedwigia **10**: 22. 1965.

add locality:

Fuegia: s.l., *Halle 96* (UPS); Lago Fagnano, *Halle 96*, cotype of *Pseudocephalozia obscura* Schuster annot. (BM).

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[12] This genus, based on the species *Lepidozia subsimplex* Stephani, was included in the Lepidoziaceae in Part II (see p. 177). With the study of two additional species it is clear that the genus *Paracromastigum* is not a member of the Lepidoziaceae but rather, belongs to a separate and distinct family along with the new genus *Leucosarmentum*.

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lower part of a segment, × 500. 2 e. Stem, ventral view, × 50. 2 f. Underleaf, × 180. 2 g. Transverse section of a stem, × 180. 2 h. Female bract, inner series, × 50. 2 i. Segment tip of this bract, × 200. 2 j. One of the lacineae of the mouth of the perianth, × 200. 2 k. Young caudex from the cauducous mass of cells, × 200. Fig. 2 a, c, d, f, k, from *Duss 49*; fig. 2 b, from *Duss 92-221*; fig. 2 e, g–j, from *Duss 242*.

2. Paracromastigum pachyr[r]hizum (Nees) Fulford, comb. nov.

Jungermannia pachyrhiza Nees in Martius, Fl. bras. **1**: 339. 1833.
Blepharostoma pachyrhiza (Nees) Trevisan Mem. Ist. Lomb. III. **4**: 417. 1877.
Cephalozia pachyrhiza (Nees) Stephani, Spec. Hep. **3**: 311. 1908.
Cephalozia asperrima Stephani, Spec. Hep. **3**: 309. 1908. [type not seen.]
Cephalozia ovalifolia Stephani, Spec. Hep. **3**: 330. 1908.
Pseudocephalozia ovalifolia Schuster, Nova Hedwigia **10**: 26. 1965.

Plants small, delicate, whitish-green rarely becoming tinged with reddish-brown, in loose mats or among other bryophytes; stems to 2 cm or more long, irregularly branched, the lateral branchs leafy, of the *Frullania* type, and ventral branches both of the *Acromastigum* type with the half-underleaf at one side, and axillary-intercalary, leafy or flagelliform, the latter very long and hyaline; in transverse section the stem with the ventral cortical cells smaller than the others. Rhizoids in tufts from the underleaves, and in 3 rows of tufts from flagelliform branches. Line of leaf insertion oblique, the leaves succubous. Leaves widely spreading, plane or concave, distant to subimbricate, ovate, bifid to one-half or less (sometimes trifid), the cells subquadrate to longer than broad; cells of the base of the segment 26–39 × 18–26 μ, the walls uniformly thickened, the cuticle coarsely verruculose. Underleaves less than half as long as the leaves, variable, bifid (some trifid) to one-half. Plants dioicous. Male inflorescence terminal becoming intercalary on the leafy stem, the bracts and bracteoles similar to the leaves and underleaves, often smaller, the bracts imbricate, concave, monandrous; antheridial stalk of 2 rows of cells. Female inflorescence on a short leafy branch, the bracts and bracteoles in 3 or 4 series, bifid, the margins of the innermost series sometimes with a short tooth on one of both sides. Perianth rather short, cylindrical below, 3-keeled above, the lobes broad, rounded, the 3-lobed mouth variously short laciniate-ciliate.

Pl. 107. Fig. 2, a–k.

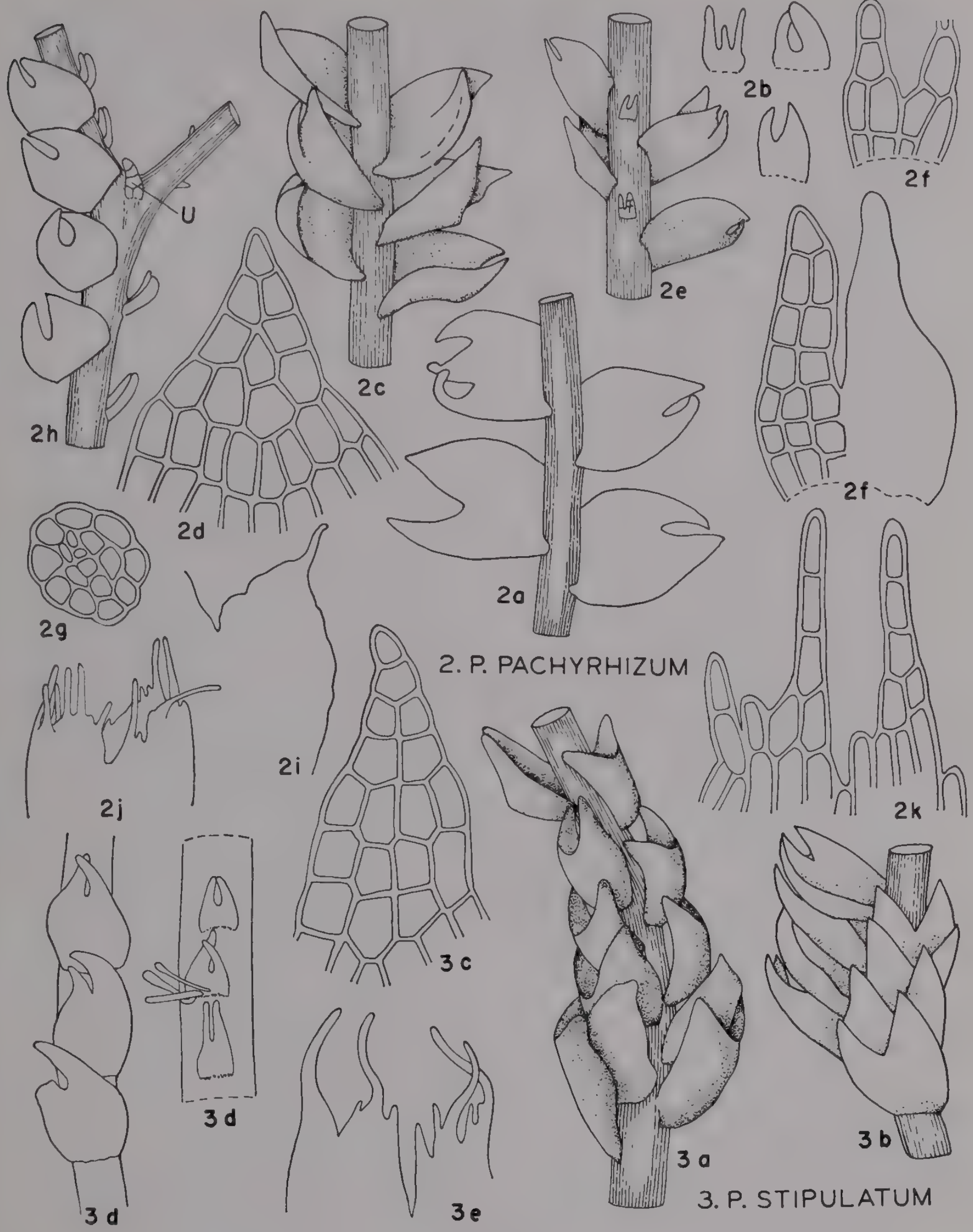
Habitat: On moist shaded banks with other bryophytes.

BRAZIL: Villa Rica, *Martius* (type S-PA, BM); Minas Gerais, *Wainio* type of *C. ovalifolia* (G-1321); the same [scraps] = type, *Pseudocephalozia ovalifolia,* Schuster annot. (BM); S. Paulo: Jardim Botânico, *Fulford, Hatcher, Hell & Vital 621* p.p., *626* (♀), *661*, *662* p.p., *665* p.p., *671* p.p. (Hb Fulford); prope Rio Grande, *Schiffner 81*, *428* (UPS); S. Paulo "Railway," 800 m, *Schiffner* (UPS); s.l., *Burchell, Cat. Geogr. Pl. Bras. trop. 3722*, *3723* (NY).

3. Paracromastigum stipulatum (Herzog) Fulford, comb. nov.

Cephalozia stipulata Herzog, Mem. Soc. Fauna Fl. Fennica **27**: 105. *f. 48, a-l.* 1951 [1952].

Plants small, light yellowish-green tinged with reddish-brown, prostrate, among lichens. Stems 0.5–1.0 cm long, irregularly branched, the lateral branches leafy, of the *Frullania* type, the ventral branches of the *Acromastigum* type with the half-underleaf at one side, or axillary-intercalary, leafy or long flagelliform; stem in transverse section with the ventral cortical cells smaller than the dorsal cortical cells. Rhizoids in tufts from the bases of the underleaves or in tufts in three rows on flagelliform branches. Line of leaf insertion oblique. Leaves patent, subimbricate, more or less concave, bifid to one-half their length, the segments narrowly triangular from a base 4–6 cells wide, acute to shortly acuminate, the cells subquadrate to longer than broad; cells of the base of the segment 30–39 × 26 μ, the walls uniformly thickened, coarsely verruculose. Underleaves conspicuous, nearly half as long as the leaves, bifid to one-half the length, the segments acute. Plants dioicous. Male inflorescence terminal becoming intercalary on the stem, the bracts and bracteoles in 6 or more series, similar to the leaves and underleaves, smaller, more compact, the bracts concave. Female inflorescence on a short ventral branch or from a flagel-


2h
U
2c
2e
2b
2f
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2a
2f
2g
2. P. PACHYRHIZUM
2i
2j
2k
3c
3d
3a
3b
3d
3e
3. P. STIPULATUM

Plate 107

FIG. 2. *Paracromastigum pachyr[r]hizum.* 2 a. Stem, dorsal view, × 50. 2 b. Underleaves, × 50. 2 c. Stem, dorsal view, × 50. 2 d. Segment of a leaf, × 200. 2 e. Small stem with underleaves, × 50. 2 f. Underleaves, × 200. 2 g. Transverse section of a stem, × 200. 2 h. Small stem with a ventral branch of the *Acromastigum* type, × 50; U, half-underleaf. 2 i. Portion of a female bract, × 70. 2 j. Outline of the mouth of the perianth, × 70. 2 k. Portion of the mouth of the perianth, × 200. Fig. 2 a, b, drawn from the type; fig. 2 c–k from *Fulford*, et al. *626*.

FIG. 3. *P. stipulatum.* 3 a, b. Stems, dorsal view, × 70. 3 c. Segment of a leaf, × 200. 3 d. Stems with underleaves, × 70. 3 e. Outline of two lobes of the perianth, × 70. Drawn from the type.

liform branch, the bracts and bracteoles in 3 or 4 series, similar to the leaves and underleaves, larger, the margins sometimes with a lateral tooth. Perianth to 1.8 mm long, cylindrical below, 3-keeled above, the mouth 3-lobed, variously short-laciniate and ciliate.

Pl. 107. Fig. 3, a–e.

Habitat: Over lichens.

CHILE: Valdivia: Dept. Corral, Quitaluto, 400 m, *Hosseus 724* (type Hb Herzog).
JUAN FERNANDEZ: Masatierra: trail to Village, 400–500 m, *Skottsberg 57* (UPS).

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